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GENERAL SCIENCE

FOR PRIMARY SCHOOLS 3

A TEACHER'S HANDBOOK OF ACTIVITIES

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NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

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GENERAL SCIENCE
for
Primary Schools

A Teacher's Handbook of Activities

VOLUME THREE

STATE INSTITUTE OF EDUCATION
BANIPUR

GENERAL SCIENCE

for

Primary Schools

A Teacher's Handbook of Activities

VOLUME THREE

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FOREWORD

Education in a developing society like ours faces a challenging task, particularly if it is not restricted to a social class. On the one hand, it has to transmit the tradition and heritage of the land and its people in a manner which is acceptable to the masses brought into the stream of education by the process of increasing democratization; on the other, it has to function as an instrument of social change. An important factor in social change being science and technology, our schools should provide adequate instruction in science the aim of which should be to teach the method of scientific inquiry as much as the knowledge of scientific principles and facts. Hence in 1963, the National Council of Educational Research and Training developed as a first step, and all-India syllabus in general science for classes I-VIII with the help of several groups of science teachers, teacher educators and science supervisors. For each area or unit of study a number of major and minor concepts were listed as a core for the development of scientific understanding of the environment. In order to help the teachers of the middle school level in developing such understanding in their pupils, a *General Science Handbook of Activities : Classes VI-VIII* was published in 1964. Our approach in the primary stage is however somewhat different. Here an attempt has been made to give to the teacher some knowledge of the concepts as well as the guidelines for using an investigatory or inquiry-based method of teaching science.

It is hoped that the present volume will help the teacher to develop new insights into science and scientific method and enable him to provide to the young child under his care some meaningful learning experience.

Shib K. Mitra

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INTRODUCTION

This teacher's handbook is intended to help teachers of primary schools to use science effectively as part of the curriculum. The handbook is written for the primary school teachers of India, especially those who have not completed high or higher secondary school and have little or no background in science.

A primary school teacher teaches in the regional language in the village school, where there are one, two or perhaps three teachers. He teaches in a small room of a simple building; his students sit on the floor. He may or may not have suitable textbooks in science; his budget for purchasing science materials is almost zero. Yet it should not be assumed that the village teacher in India has no resources for the teaching of science. Rural children here are very close to their environment. They are surrounded by plants and animal life on their farms and in their hamlets. They are more aware of weather, climate, of water supply and problems of keeping cool than are children in larger cities.

At an early age they have learned about fuels as sources of heat and light, and about the nature of the night time sky. Many primary school children have had abundant experience in carrying on household tasks and village activities which involve the principles of science. Thus in many ways, the rural children of this country, like those of many other countries, have a remarkable start towards learning about science.

Although village schools have little or no special equipment for the teaching of science, they have many useful resources on which they can draw. There is science involved in everyday food, clothing and housing. Many science principles are illustrated on the farms, in the kitchens, and in the village bazars. Many everyday items, such as earthen pots, electric torches, glass jars, string and paper, rocks and soils, can be used to help teaching science.

It is the purpose of this handbook to help the teacher who is inexperienced in science teaching. The teacher can make use of children's experiences with everyday materials in teaching scientific principles as well as the nature of science.

Why teach science to children?

The effective way to approach the answer to this question is to analyze what is the nature of science and what is it that scientists do? Unfortunately there are wide misunderstandings about these things. There are many who believe that science is simply a collection of theories and principles, facts and formulas, special methods and scientific names. They believe that a scientist is one who has learnt all such things and is prepared to draw upon his memory in his scientific work. This description is far from accurate. Science is more than a collection of knowledge; it is also the intellectual activity in which scientists are engaged. That is, science is not just a subject—it is also a pattern of methods for solving real problems, large and small, scientific and otherwise.

Science is also a set of attitudes about doing things and about thinking—a background of appreciations of the natural and man-made environment. When scientists work, it is true that they draw upon what they have learnt in the past. Yet memorization is not their most valuable asset. The best of human memories often fails. New ideas of science are developed very rapidly long after a scientist has finished his university training. Very typically the scientist is called upon not simply to recite what is known, but rather to find out what is not known. Thus the work of a scientist is far from being a matter of repeating learned knowledge. Research is much more of a creative process where the scientist finds new knowledge or applies existing principles to new situations.

Science does involve the learning of knowledge and of skills. But this is only a part of science. Another important aspect of science includes the methods scientists use to gain new knowledge, the attitudes involved in their behaviour. Science also includes the activities of scientists, and the role of science in society. Science is not merely what scientists know; it is also what scientists do.

These two aspects of the scientific enterprise are described in many terms: 'subject' and 'method', 'content' and 'activities' 'knowledge' and 'behaviour'. A well accepted pair of terms is used throughout these pages—'product' and 'process'.

What is meant by *product of science*? This is the side of science familiar to most teachers and students the world over. This is the side which is basically knowledge, including facts and figures, formulas and equations, principles and scientific laws. This is, indeed, the side of science to which most teaching effort in most countries has usually been directed.

By *process of science* is meant the things that scientists do. This includes the way they locate information in books and magazines, the way they learn through observation, the way they experiment (that is, manipulate the environment for purposes of special observation). This also means the way they develop ideas of what *might* be true, the way they test these ideas, and the way they communicate the ideas to others. This is the sort of thing often referred to as *scientific methods*. Not only scientists, but all men and women and boys and girls can become more successful, more satisfied individuals if they have competence along these lines.

Process of science also includes the patterns of thinking sometimes called *scientific attitudes*. This means curiosity, honest doubt, tolerance for the opinions of others, and suspension of judgement. This also includes willingness to admit when one is wrong, and an inclination to make decisions on the basis of evidence rather than tradition, superstition, or emotion. People—scientists and others—are better off if they act in these ways.

Process of science also means the role of the scietific enterprise in a modern nation. This includes the part to be played by science in improving agriculture, health, industry, communication and transport of a country. It means the function of science is to improve general standards of living and help establish personal and national security. Perhaps most of all, it means the thing that science and scientists do—they seek satisfying explananations for the things they observe. Seen thus, science is a specialized kind of curiosity, a high intellectual enterprise in which each and all can participate, each at his own level.

If this is the modern concept of what science really is, what has it to do with Indian children at the primary school level? There are two kinds of ways in which science affects these children.

For one thing, these children are affected as individuals growing up in a modern world which is very different than it was even one generation ago. These children are affected by much of the progress which science has brought. They use plastics, synthetic fibres and medicines which were almost unknown when their parents were young. These children are directly affected by new means of communication such as telegraph, radio and cinema and also by better methods of transportation. These children are affected by fertilizers and hybrid seeds for better crops, by irrigation and other methods of farming, by new standards of sanitation. They are affected by the need for population control, and by new kinds of tools and machinery, electricity and chemical power, which are being increasingly used in their daily lives. A child growing up in this changing world must learn about these new features of his environment.

Children are also affected by the ways in which scientists work. In a very real sense children must be their own science specialists. Children need to find out new information, they need to arrive at an understanding of what is going on about them, they need to make judgements and decisions concerning what they will do in many walks of life. These tasks of children are very close to the activities of scientists. Thus the *process of science* as well as the *product of science* are things which are extremely important to very young children.

There is yet another way in which science affect people through the impact that it has on the society in which they live. Improved means of communication and transportation are helping to bring even the most remote village into some kind of contact with the rest of the world. Increased production of goods and better demand for human services are changing not only our standard of living but also our patterns of daily activities. The over-crowding of population brings a new and imperative need for national efforts on birth control.

It is much more difficult for a modern child to understand science in its broadest sense than it was even a few years ago. While it is true that there is far more science to be learnt today than there was a generation ago, this is not what makes modern science learning such a large task. Rather the learning of science today is difficult because it is so complicated. The modern young person must not only know some principles of science, he must know how to apply them and he must know how to find new information when he needs it.

For these reasons we must start children on their task of learning about science as early as possible. There is ample evidence to show that children at pre-school age can learn some simple principles of science. What is more important, they can use the process of science effectively. For example, most of what children learn until they are three or four years old is learnt strictly through observation and experience—the basic tools of the laboratory scientist! Pre-school children can acquire important attitudes about science—attitudes such as curiosity, tolerance of others' ideas, and respectful doubt of established authority. The sooner we start teaching science to young children the better. At the present level of the development of primary school education in this country, the best that can be done for all children is to start with class I.

How should science be taught?

A valuable tool for methods of teaching science can be found in the analysis of science on the previous pages. If science is *process* and *product*, then it should be taught as such. If it is true that sheer memorization of facts and principles is not of supreme importance to a scientist, then science should not be presented in this way to children. If it is true that problem solving, decision making, creative curiosity, and effective inquiry are fundamental features of science, then these kinds of activities should be abundantly present in school science for children.

This does not mean that science teaching should not include knowledge. What it does mean is that knowledge is to be *understood* rather than merely memorized. It does mean that not all knowledge known to scientists can be included in the curriculum. Rather one must select those ideas in science which will be most useful to young people. Furthermore, the selection of science subject matter should be made in terms of broad understanding which ramify throughout human experiences. These broad understandings are often referred to as 'conceptual themes'. These are broad and sweeping ideas which cut across the conventional compartments of subject matter. These ideas have application not only in scientific laboratories but also in the daily lives of common people. The following list of fifteen conceptual themes is typical of this new approach to the selection of subject matter.

1 Every effect has its cause or causes.
2 Scales for time, position, size and motion in space are relative, not absolute.
3 Natural laws are universal, demonstrable through time and space.
4 Dissimilarity and diversity are normal qualities in natural phenomena.
5 In spite of natural diversity, there are patterns of similarity among things in the universe; they are amenable to useful man-made system of classification.
6 Change is a normal condition in the dynamic continuity of nature.
7 In spite of natural change, the influence of heredity tends to maintain characteristics of living things from one generation to the next.
8 Interdependence and interaction with environment are universal relationships in nature.
9 Matter is particulate in nature.
10 Energy interchanges accompany every natural occurrence.
11 Energy can be transmitted in a variety of forms and manners.
12 Fields of influence extend beyond the place of their origin.
13 Equilibrium is a condition towards which all systems in the universe tend to evolve.
14 Living organisms are highly specialized systems of matter and energy.
15 The sum total of matter and energy in any isolated system remains constant.

These conceptual themes have been deliberately woven into this handbook. At many points throughout the pages of the guide, specific reference is made to one or more of them. The suggested learning activities and the selected special sections for the teachers (For Better Understanding) focus attention on these conceptual themes and suggest to the teacher ways in which he can make them understandable to students.

What are the characteristics of children?

The science of educational psychology is adding much to the experience and wisdom of adults to help us understand better the nature of young children and the ways in which they learn. The interests and attitudes of young children vary with their age. Sometimes these characteristics vary with the environment—rural or urban—in which they happen to be placed. The atmosphere in the family and the school also contributes to their development.

A six or seven-year-old child usually shows signs of self-assertion and hates imposition by others. He is extremely inquisitive and wants to explore, feel, touch, and use all his senses. He has a keen sense of competition and wishes to outdo his peers. He fondles young animals and tries to make friends with them. He collects things such as clay, bricks, stones in the environment. He engages himself and his peers in make-believe construction, cooking and other activities. He likes to play with toys. He attempts to make them and destroy them soon after. His attention span is about fifteen minutes. Encouragement helps him a lot in his endeavours and investigation.

Very careful handling by parents and teachers is needed to develop and mould the character of a child of this age. He should not be burdened with tasks which he is incapable of doing. He needs careful and close supervision in the classroom. As his attention span is small, it will be helpful if two or three activities of different types are put into a single class period of 30-35 minutes.

The eight-year-old child just begins to think logically and makes an honest effort to express himself properly through the media available. He begins to distinguish facts from fiction. Usually, he has a great deal of energy which is manifested through physical exercises. He runs when he could walk. This energy should be properly channelled for useful purposes through activities of various types in which the child often takes great interest.

The nine-year-old child starts developing his own interests. He is less dependent on his teachers and elders than when he was younger. He can understand simple relationships of time and space and appreciate the past and the present. Often he does not accept a statement unless he really believes it. This is, therefore, just the stage when he should be directed to plan ways to find answers for the questions that he raises.

The ten-year-old child is capable of doing some rather critical thinking. He continues to be inquisitive and takes great pleasure in experimenting and finding out new things. At this age he develops special interests and likes to work in groups. He is more mature now and can understand more complicated relationships than when he was younger. He takes interest in reading books on adventure. He is increasingly able to appreciate the role of scientists and scientific achievements.

What is known about how children learn?

It is known from research in educational psychology that children do not learn best by simply being told. Rather, they learn better when they are personally involved in activities related to the subject at hand. Briefly, children learn by doing; so do adults. It will always be necessary for students at any age level to learn much knowledge by reading it or by listening to it. Wherever possible, however, teachers should plan their programme in such a manner that children have a chance to learn through activities. Teaching science is not 'telling science'. Teachers need to provide rich variety of real learning experiences through which children can learn. Learnings acquired in this way are more meaningful and less forgettable than learnings acquired merely through listening and reading. Wherever possible, teacher should try to help students develop ideas about science on the basis of first-hand evidence.

Educational psychology has clearly shown that learning on the basis of meaningful activities leads to better understanding of scientific principles and to permanent learning of related facts. It is also obvious that this pattern of learning helps children learn not only the product but also the process of science. After all, the development of principles based on first-hand observation is thoroughly characteristic of the process of science.

The activities of this handbook are selected and described in such a way as to emphasize this kind of learning. At the same time, they are selected in such a way that they will lead to a knowledge of facts and an understanding of principles of science. In this way, the teaching of *science product* through an approach which emphasizes the *science process* makes for better overall learning of science from the broadest possible point of view.

This teacher's handbook is not intended as a course of study to be rigorously followed. Furthermore, this guide is not a set of lessons to be used by the teacher. Rather the handbook is intended a teacher's resource, a collection of ideas to which he may refer for improved teaching of science to his children.

It is very clear that patterns of teaching science vary throughout the nation. Certainly they differ from state to state, from district to district, and from school to school. The purpose of this teacher's handbook is to help each individual teacher develop the local pattern of science teaching to new levels of effectiveness.

What syllabus does this teacher's handbook follow?

This handbook is structured on the basis of the "General Science Syllabus—Classes I-VIII" published by the National Council of Educational Research and Training in 1963. There have been some modifications in the details of that syllabus, and correspondingly in this handbook. A few such examples are given below:

1. The unit on 'Energy and Work' has been rewritten and enlarged. This has been done because of the conviction that concepts of energy and work are too important to postpone until class IV. Fortunately many of these concepts can be understood by children in the first three classes. Accordingly this unit has been enlarged and distributed among all of the first five classes.
2. The unit on 'Matter and Materials' has been given a treatment similar to that of the unit on 'Energy and Work' for the same reasons. This, too, has been enlarged and distributed among classes I through V.
3. The unit on 'Scientists at Work' has been distributed among all of the units of the syllabus. It is felt that the accounts of scientists' activities are more

meaningful if they are taught in conjunction with a related conceptual theme or an appropriate unit of work.

4 The unit on 'Measurements' has similarly been redistributed among appropriate units. Most of the concepts formerly in that unit are now found in the units on 'Our Universe', 'Air, Water and Weather', 'Energy and Work', and 'Matter and Materials'.

In spite of these modifications in the 1963 General Science Syllabus, the teacher will have no difficulty in using this handbook to teach the older version of the syllabus.

Thus the thirteen units of the original "General Science Syllabus Classes I-VIII" have been reduced to eleven in number. For purposes of this publication these eleven units have been rearranged into three major sections. These sections are bound into three separate volumes, of which this is the third one. These three new volumes, the new arrangement of units and their new numbers are shown in the chart below:

VOLUME 1—THE EARTH-RELATED SCIENCES

Unit 1—*Our Universe* (formerly Unit 12)
Unit 2—*Air, Water and Weather* (formerly Unit 1)
Unit 3—*Rocks, Soils and Minerals* (formerly Unit 2)

VOLUME 2—THE PHYSICAL SCIENCES

Unit 4—*Energy and Work* (formerly Unit 6)
Unit 5—*Matter and Materials* (formerly Unit 7)
Unit 6—*Housing and Clothing* (formerly Unit 5)

VOLUME 3—THE BIOLOGICAL SCIENCES

Unit 7—*Living Things* (formerly Unit 8)
Unit 8—*Plant Life* (formerly Unit 9)
Unit 9—*Animal Life* (formerly Unit 10)
Unit 10—*Human Body, Health and Hygiene* (formerly Unit 3)
Unit 11—*Safety and First Aid* (formerly Unit 4)

Thus this three-volume edition of "Science for Primary Schools—A Teacher's Handbook" is arranged into three logical sections. However, this does not imply that children are to be led in their science learnings through this kind of subject-matter organization. This highly logical subject-matter organization appeals to the view of the scientist and meets the needs of curriculum workers and classroom teacher. However, it does not represent the interests of children nor the ways in which they learn.

How can this handbook be useful?

Each class level of each unit is introduced by an overview. This is intended to help the teacher to see what is involved in this unit at this class level, to realize why it is important in the education of children, and to learn what students already know about this unit.

Each of the eleven units of work at each class level is divided into major concepts. Each sub-concept begins with a brief statement concerning the knowledge and understanding involved. This is intended as a condensed lesson for the teacher. Next appear one or more learning activities which are useful in helping students understand the sub-concept. These learning activities are of several types such as:

Investigation

Discussion
Class Project
Field Observation
Interview
Familiar Experience

Whatever the type of activity, it is printed in a heavily starred box for easy identification. This heavy box includes the title of the activity, the materials needed, the instructions for carrying out the activity, and often an illustration.

In addition, each sub-concept contains one or more additional activities briefly suggested. These are printed in a lightly dotted box for easy identification. Unlike the heavily boxed activities, these are merely quick suggestions without detailed instructions.

A special kind of learning activity—'Scientists at Work'—appears several times in each unit. These selections are located immediately after an appropriate sub-concept, or at the end of a class level. Each 'Scientists at Work' activity is basically a story for children. It is intended that the teacher should read the story for thorough understanding; then he should relate it to the students using his own words and style of presentation. This is a much better procedure than simply to read 'Scientists at Work' to the class.

In many places the teacher needs additional background over and above what he might teach to children. This has been included, where needed, under the heading 'For Better Understanding'.

Where can teachers get help for science teaching?

It is hoped that this handbook will interest teachers throughout the nation in a serious attempt to improve science teaching. If you are so interested, you will surely need additional help. Here are some of the ways in which you can seek and find such assistance:

(a) Keep your eyes open to the everyday materials familiar to children. Once you know how to look for such materials, you will find that some of the most common and ordinary things in daily life can be used to teach science very effectively. You will find many examples of such use of common materials in the boxed activities of this handbook. With practice you can learn to find and use many more.

(b) Take advantage of experts in the community. Although they may not have national fame, there are genuine experts in many fields in every community. There are successful farmers and good cooks; there are experienced merchants and skilful mechanics. Many parents are experts in some everyday field related to science—a field such as the making of thread and cloth, or the maintenance of carts and other farm tools. Nearby there are doctors, merchants, tailors and potters, health officers, district development officials, and the like. Take every opportunity to have such people come to your class or to have students seek them out and visit them where they work. In this way, children will not only learn the related science but will also learn much of value about their own community.

(c) Take full advantage of inexpensive printed materials such as newspapers, magazines, and books.

(d) Consult the science teaching experts from the State Institute of Science or the State Institute of Education to get such help as you can. Most of these specialists are located in the state capital, but make frequent trips throughout the states. Write to them and seek their assistance.

(e) Contact extension centres for primary education and the teacher training colleges nearest to you. Each of these institutions has one or more experts in science teaching. Usually they can provide assistance if you specifically ask for it.

What is there to read?

Here is a selected bibliography of publications about science and science teaching. It is designed to include materials which are readily available and relatively inexpensive.

The teacher who earnestly seeks to improve his science teaching programme needs many kinds of help. Among other things he needs books—books about science content, and books about ways of teaching science.

Many teachers in our country have difficulty in finding suitable books to help them teach science better. Although such books are not as plentiful as they should be, the situation is getting better. The list which follows includes books that are not only of great value to the primary school science teacher but are also apt to be available to him.

LIVING THINGS, PLANT LIFE AND ANIMAL LIFE

1. Craig, Gerald S., and others. *Science Today and Tomorrow Series*. Boston : Ginn & Co.
2. Gilbert, Miriam. *Starting a Terrarium*. C.S. Hammond and Company.
3. Gilbert, Miriam. *Starting an Aquarium*. C.S. Hammond and Company.
4. Hogner, Dorothy. *The Dog Family*. London : Oxford University Press.
5. Jocobson, Willard and others. *Thinking Ahead in Science Series* (also Teacher's Annotated Edition) American Book Company.
6. Lemmon, Roberts. *Junior Science Book of Big Cats*. Frederick Muller Ltd.
7. Selsam, Millicent. *How the Animals Eat*.
8. Sheldon, William D. *Junior Science Book of Elephants*. Frederick Muller Ltd.
9. Thurber, Walter A. *Exploring Science Series*. Allyn and Bacon.
10. Terr William A. *An Adventure Book of Birds*. Capital Publishing Company.

GENERAL

1. Zim, Herbert S. *The Golden Book of Encyclopedia of Natural Science*. Golden Press.
2. Parker, Bertha M. *Basic Science Education Series*. Row Peterson and Company.

Titles under the authorship of Parker, Bertha Morris are (1) *Six legged neighbours* (2) *Gardens indoors* (3) *Insects and their ways* (4) *Toads and Frogs* (5) *Animals of the seashore* (6) *Domesticated animals* (7) *Fishes* (8) *Saving our wild life* (9) *Animal travels* (10) *Living things* (11) *Birds* (12) *Plant and animal partnerships* (13) *Life through the ages* (14) *Insect friends and enemies*

(15) *Animal world* (16) *Soil* (17) *Seeds and seed travel* (18) *Spiders* (19) *Insects and their ways* (20) *Adaptations to environment.*

Titles under the authorship of Glenn O. Blough are:
(1) *Useful plants and animals* (2) *The pet show* (3) *Birds in the big woods* (4) *Plants round the year* (5) *Animals and their young* (6) *An aquarium* (7) *Animals that live together.*

HUMAN BODY, HEALTH AND HYGIENE

1. Best, C. H. and Taylor, N. B. *Human body, its anatomy and physiology*. Holt, Reinehart and Winston.
2. Davies, M. B. *Hygiene and Health Education*. Longmans.
3. Goodwin, L. and Diggen, A. *A New Tropical Hygiene*. Allen and Unwin.
4. Seligmann, A. W. *The Human Body—What it is and how it works*. New York: Golden Press.

UNIT 7

LIVING THINGS

CLASS III

Overview

The children are aware of the various kinds of plants and animals that live in their surroundings. The knowledge of the children about the diversity of animal and plant life was consciously organized in classes I and II through the lessons on 'Plant Life' and 'Animal Life' (Units 8 and 9). The children have identified living things as a *group*. They have contrasted the living things with other materials around them in their day-to-day life. They have observed and learnt that living things require food for their life; they grow and they reproduce young ones. They are distinctly different from non-living things.

With this background children enter into class III. Here they survey various kinds of living things. They are helped to find out that living things fall into two main categories, namely, *plants* and *animals*. They find that man as a living thing shares many of the characteristics of animals, and that man is an animal.

Then they proceed to learn the basic characteristics of living things. Some of these characteristics, like growth, reproduction, and death, are already known to them. They learn here that living things respire and respond to stimuli. They have observed these characteristics to be common in all living things—whether they are plants or animals. But from their experience they know that plants as a group of living things are very much different from the animal group. They now go deeper to find out what distinguishes plants from animals. They learn that plants are generally green, manufacture their own food, and mostly do not move from place to place. The animals cannot manufacture food, and they do move from one place to another. The children are helped to appreciate the important position of plants as the producers of food for all animals, including man.

The two key ideas developed in this class are *similarities* and *differences*. After observing the various activities of living things the children come to certain conclusions about the nature of living organisms. Certain characteristics are common to all living things. The living things are classified or differentiated into plants and animals on the basis of the differences in their life activities.

1. THERE ARE MANY KINDS OF LIVING THINGS

Children come across different sorts of things in their everyday life. Some of these are non-living. Objects like stones, books, pieces of wood, and metallic objects, are all examples of non-living things. They need no food; they cannot grow; they cannot reproduce young ones. In contrast to these objects, children also come across certain other things all of which require food, which grow, and which produce new generations. Such objects are plants or animals. Thus all animals and plants are called *living things*.

1(a). HUMAN BEINGS ARE LIVING THINGS

Any object is either a living thing or a non-living thing. To which group does man belong? Man resembles animals in many ways. Man, like other animals, is a living thing. Of course, he is a very special kind of animal.

The following activities will help the children to appreciate that human beings are living things.

Discussion **Why are human beings considered to possess life?**

Help the children to compare their own bodies with objects like tables or chairs. Point out that the tables or chairs do not need food; these do not grow or need air for breathing. Their own bodies need food and air. Their bodies grow bigger. Help the children to draw the conclusion that man is very much different from a non-living object; human beings are alive.

1(b). ANIMALS ARE LIVING THINGS

There are many kinds of animals. They differ in many ways. But there are some characteristics that are found in all animals. It is these qualities that distinguish these animals from non-living objects. These qualities help us to classify them as living objects.

With activities like the following, the teacher can help the children to understand that although animals differ from one another, they are alike in that all of them are living things.

Field Observation **What qualities do all animals have in common?**

Arrange a trip for the children to any nearby place like a garden, park, or field. Help them to observe the different kinds of animals like squirrels, sparrows, lizards, butterflies, and ants. Ask them to find out what qualities are shared by all of them. (They eat, they grow, they move, they have young ones.)

Discuss as to how these animals are different from objects like stones.

Help the children to make a picture-chart of living things and *non-living things. They can collect pictures of certain things and draw a few of them.*

1(c). PLANTS ARE LIVING THINGS

Introduce this concept by inviting the children to name some common trees and garden plants as well as wild plants. After the children have named the plants, let them say whether the plants are living or non-living objects. With a hand-lens, children can examine bread moulds. They can see mushrooms. Children can be told that some plants bear flowers and are green, whereas others are non-green and have no special organs like branches, leaves, etc. But both these types are living plants. The following activities may be undertaken to help the children understand that all plants are living things.

Investigation

Why are plants classified as living things?

Materials required
bean seeds
germination box
with one side
covered with glass

Place some soaked bean seeds in the soil contained in a box. Let one side of the box be of glass. Sow the seeds 3 cm deep. Encourage the children to watch the seedlings daily and observe them growing day by day. After observing for a few days, let the children stop watering the seedlings. They will see the plants wilting and, finally, dying. The children have observed two characteristics of living things in plants, namely, growth and death.

Help the children to arrange a display of living and non-living things. Group these things into two categories using the needs of living things—food, water and air—as a means of categorizing the items displayed.

2. LIVING THINGS EXHIBIT CERTAIN CHARACTERISTIC ACTIVITIES

Children have observed the young ones of animals living with the adults. For example, they have seen puppies with dogs, kittens with cats, calves with cows. They know that the adults gave birth to these young ones. These young ones grow in size and in course of time become adults. Whether it is an adult animal or the young one, it needs food. By taking food these young ones become bigger.

Similarly children have also seen the plants growing. The grown-up plants produce seeds which give rise to new plants. Plants also need food. Plants are capable of manufacturing the food materials they need.

Ultimately all living things die.

2(a). LIVING THINGS GROW

All living things, whether plants or animals, grow. Growth is a process with which the children are familiar. They have seen the kittens growing into adult cats, calves into cows or oxen, puppies into dogs, etc. They are familiar with small saplings growing into large trees. Above all, they are also conscious of the growth of their own bodies. It is a familiar experience for the children that the skirts and shoes which they are wearing appear to become small for them as time passes. Their height and weight increase as time goes by.

There is a difference between the growth of animals and plants. Animals cease to grow after some time. Plants often continue to grow indefinitely throughout their lives.

With activities of the following type the teacher can help the children to understand that all living things grow.

Investigation

How do we know that plants grow?

Materials required
bean seeds
pots

Allow the children to sow some bean seeds in pots and regularly water them. After a few days, small seedlings will sprout. Encourage the children to draw pictures showing different stages of growth of the seedlings at intervals of one week. After four weeks, the plants will be quite big. Help the children to observe the plants after eight weeks. They will find that the bean plants are still growing higher. Encourage the children to record the length of the same seedling at different intervals of time. See Fig. 7-1.

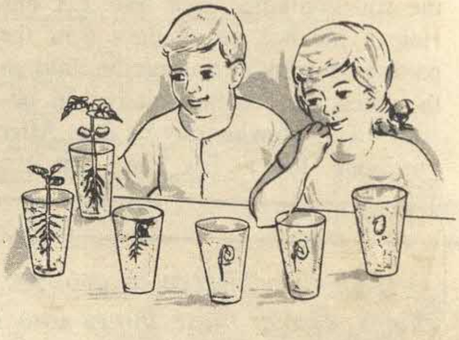

Fig. 7-1
When seedlings grow, they increase in length.

Class Project

How can we know how much a kitten or puppy has grown?

Materials required
puppy or kitten
measuring tape or
thread and scale

Ask the children to find a kitten or puppy. Help them to measure its height, length, body girth and to record the data in a note-book. Help the children to get the same animal periodically and make the measurements and record them in the note-book. Draw the children's attention to the gradual increase in the measurements. See Fig. 7-2.

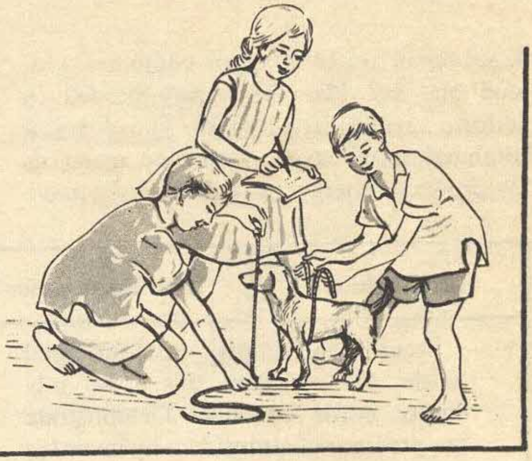

Fig. 7-2
When a puppy grows, it increases in height, length and body girth.

Class Project

How much have you grown during six months?

Materials required
measuring tape
weighing machine

Help each child to take the measurements of his height, weight and chest. Help him to draw an outline of his palm and sole. After six months, let the measurements and outlines be repeated. Help the children to compare these two sets of data and to understand how much they have grown. See Fig. 7-3a, b.

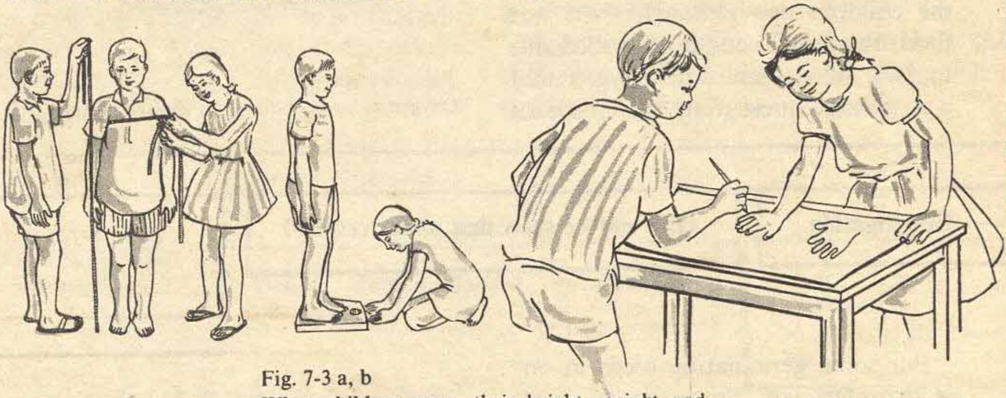

Fig. 7-3 a, b
When children grow, their height, weight and chest, etc., increase.

2(b). LIVING THINGS RESPIRE

Living things need oxygen to sustain life. Organisms take the oxygen either from the air in the atmosphere, or from that

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dissolved in water. Oxygen combines with food and provides the energy needed to perform various life activities. The chemical combination of oxygen with food materials to produce energy is called *respiration*. During this process carbon dioxide is formed.

The children may be encouraged to perform the following activities to help them to understand that living things respire.

Investigation

Is air essential for the life of animals?

Materials required
wide-mouthed bottle with lid
vessel for water
rat or mice

Secure an empty wide-mouthed bottle. Discuss what this apparently empty bottle contains. Demonstrate the presence of air inside it by inverting and immersing in water. Point out that the air from the bottle escapes as bubbles. See Fig. 7-4a.

Put a mouse in the bottle, along with some food such as wheat grains. Close the lid so that no air goes into the bottle from outside.

Observe the mouse carefully. In a few minutes it will become less lively. Quickly let air into the bottle so as not to torture the animal. Tell the children that although there was food, the animal could have died due to lack of oxygen. The oxygen that was already present in the bottle at the beginning was used up by the animal during respiration. See Fig. 7-4b.

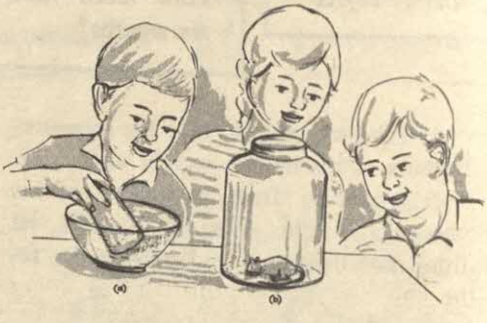

Fig. 7-4 a and b.
Oxygen in air is essential for the life of animals.

Investigation

How can we show that plants respire?

Materials required
glass jars with lid
seeds
splinter

Put some germinating seeds in one of two glass jars. Put some dry seeds in the second jar. Close each with a tightly-fitting lid. After two days remove the lid and introduce a burning splinter into each jar. The splinter will be extinguished in the jar containing germinating seeds. This shows that oxygen was consumed by the germinating seeds. In the other jar the splinter burns normally. This investigation indicates that plants respire. See Fig. 7-5.

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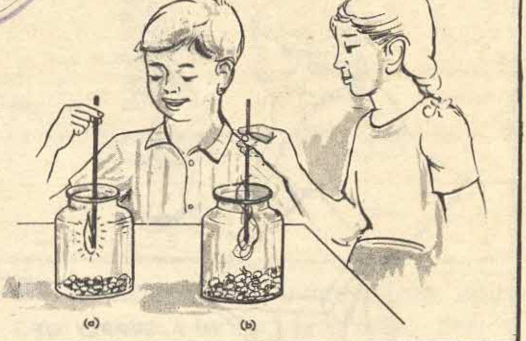
Fig. 7-5 a
The splinter continues burning in the jar with dry seeds because germination did not occur and oxygen was not consumed.

Fig. 7-5 b
The splinter is extinguished in the jar with germinating seeds because oxygen of the air in this jar has been consumed during germination.



Help the children to find out how many times in a minute they breathe. Breathing one time includes the inhaling and exhaling of air. Let them compare this rate with that of a dog or cat or cow.

For Better Understanding

Sometimes people get confused between breathing and respiration. Breathing refers to the inhaling (taking in) and exhaling (giving out) of air. Respiration, on the other hand, refers to the process of food combining with oxygen in the tissues.

2(c). LIVING THINGS RESPOND TO STIMULI

Heat, light, water, and some chemicals are stimuli. When living organisms come into contact with these or other such stimuli, they react. This reaction is called *response to stimuli.* Living organisms respond differently to different stimuli.

The activities given below will help the children to learn some of the ways in which living organisms respond to stimuli.

Investigation

How do plants respond to light stimuli?

Materials required
bean plants
tin can or cardboard box

Help the children to select two small potted plants like a bean or a balsam. Let them keep one pot in the open so that it gets light from all directions. Let them keep the other plant covered with a tin can or a thick cardboard box with a small opening on one side, as in Fig. 7-6. In such an arrangement the plant gets the light from one direction only. The plant will bend towards the source of light in two or three days. Help the children to observe that the stimulus of light coming from one direction caused the plant to respond and bend towards the light source.

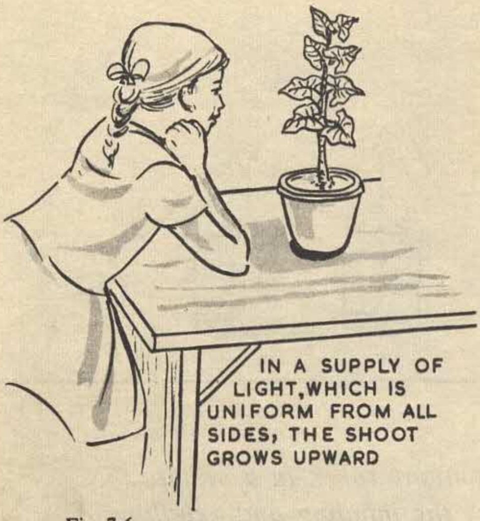
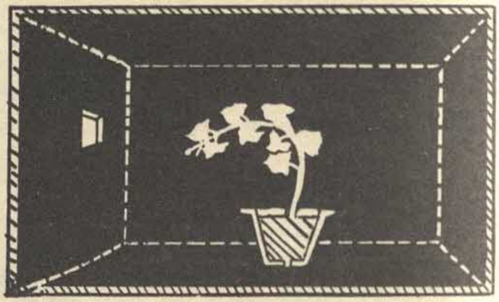

IN A SUPPLY OF LIGHT, WHICH IS UNIFORM FROM ALL SIDES, THE SHOOT GROWS UPWARD

Fig. 7-6
Shoots grow towards the source of light.



When a plant gets light from one direction only it bends, growing towards the source of light.

Investigation

How do snails respond to salt?

Materials required
snail
salt
glass plate

Obtain a snail for the class. Allow the snail to move on a glass plate. Let the children watch how a snail moves. Ask the children to sprinkle a little salt in the path of a moving snail. Help them to observe that the snail senses the presence of salt and then moves in a different direction. Help the children to appreciate that the chemical stimulus of salt has made the snail respond and change its direction of movement.

Demonstration

How do ants react to heat?

Obtain a cup-shaped mud pot or a half-shell of a coconut. Smear its inside with jaggery. Leave it outside the classroom or in the garden to attract ants. The ants will come and collect in large numbers. Apply heat to one side of the shell. Let the children watch the ants leaving the warm part of the pot. The ants cannot stand excessive heat. They respond to the stimulus by leaving the heated area. See Fig. 7-7.

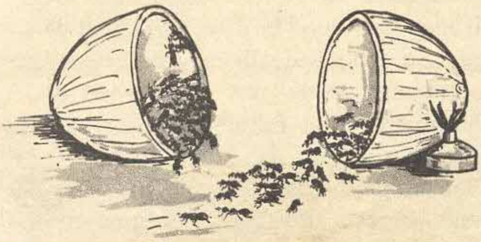


Fig. 7-7
Ants move away from the warm part of the pot.

2(d). LIVING THINGS REPRODUCE THEMSELVES

Most familiar plants produce seeds. The seeds when sown give rise to new plants. In some plants a stem-cutting will grow into a new plant. Examples of this type of plant are sugar-cane, rose, and crotons. Potatoes and ginger can be grown if their underground stems are planted. Non-green plants like mushrooms and breadmould do not produce seeds. They produce spores. The spores grow into new plants.

Children are familiar with domestic animals like cows, horses, sheep, dogs, and cats. These give birth to young ones. Birds, some snakes, turtles, crocodiles, lizards, frogs, fishes and insects produce eggs. The young of these animals hatch out of the eggs and grow into adults in course of time.

Irrespective of the mode of reproduction, all living things reproduce. They reproduce their own kind. The following activities will help the children to learn that one of the important characteristics of all living things is reproduction.

Class Project

Let's watch the germination of seeds

Materials required
pots
seeds
garden implements

Help the children to plant the seeds of some plants like bean, mustard, wheat, and maize in pots. Let them water the plants regularly. Help them observe the seeds germinating and growing into their respective plants.

Field Observation

What can we learn about young animals?

Take the children on a trip to a nearby field, garden, or farm-house. Show them a variety of animals with their young ones. Discuss which of the animals give birth to young ones and which lay eggs. Show them the eggs and young of as many animals as possible. Discuss that one of the characteristics of animals as living things is reproduction.

2(e). LIVING THINGS DIE

All living things have a limited span of life. They carry on various activities, which characterize them as being alive, e.g., growth, respiration, response to stimuli, reproduction, during a life span of perhaps a few minutes (as in bacteria) to many years in higher animals and plants. All organisms die. Death can thus be defined as the cessation of all those activities which characterize the living. Death is the end of life.

Children have often seen a dead creature. It may be a dead bird or a dead cat or some pet. Sometimes death may be premature or accidental. Dogs may be crushed under a heavy truck, or rabbits may get shot by a gun. Birds may be killed in heavy rains. Sometimes diseases cause death. Many plants and animals, however, continue to live a full span of life and die when their bodies become old and worn out.

Field Observation

Under what circumstances do plants die?

Materials required
pot
seeds

Help the children to germinate a few bean seeds and grow the seedlings. Help to water them regularly and observe their development. After some time ask children to stop watering. Without water the plants wilt and, finally, die. Discuss how the plant that grew and lived, died when its supply of water was cut off. Discuss that plants may also die of disease, excess of rain, heat, or other hard circumstances.

Group Discussion

Help the children to describe the various dead animals they have seen. Discuss with them the circumstances under which animals die. Diseases, accidents, lack of water, shortage of food, and ageing are typical causes for the death of animals.

3. PLANTS AND ANIMALS DIFFER IN MANY WAYS

Children have learnt that living things may be either plants or animals. They all have certain life activities in common. Thus both plants and animals need food; they grow, reproduce their kind and react to stimuli. Living things are classified into plants and animals according to certain differences between them.

Animals move from one place to another. Familiar plants are usually stationary. The branches of a tree move in different directions in a limited way, but the tree does not move from place to place. Another important difference is in how the plants and animals get their food. Plants are mostly green in colour. Green plants manufacture their own food. Animals are not capable of making their own food. They eat the food made by green plants.

3(a). GREEN PLANTS MANUFACTURE THEIR OWN FOOD

Green plants, like all living things, need food. They manufacture their own food in their leaves. For manufacturing food they require certain very simple substances. The substances are carbon dioxide, water, and mineral salts. These mineral salts are present in the soil. The roots of plants which are in the soil take in these salts dissolved in water. Carbon dioxide is obtained from the air. The plants have a complex chemical called *chlorophyll*; it is green and gives the leaves their characteristic colour. The manufacture of food also requires energy; this is supplied by the sun.

With the following activities the children can be helped to understand that green plants use the energy of sunlight to manufacture their food from air, water, and minerals.

Investigation

What happens to plants if they have no water?

Materials required
pots
bean seedlings

Have the children secure two similar plants; bean seedlings may be used for this purpose. Let the children plant one in each pot. Ask them to leave both the pots in sunlight, but water only one. Let the other plant be left without water. Help the children to observe that the plant in the pot without water wilts, and contrast this with the plant in the pot which was watered regularly. Help them to draw the conclusion that water is essential for the plants. One of the processes of plants is the preparation of food. Water is one of the essential things needed for this purpose.

Investigation

Is sunlight necessary for plants?

Materials required
pots
bean seedlings

Help the children to prepare two pots, with one plant in each. Let the children leave one plant in sunlight. Let the other pot be left in a dark place. Instruct the children to water both pots regularly.

The children will observe that the plant kept in sunlight grows well. Help them to contrast this with the plant grown in a dark place. It looks sickly and thin. This is because it cannot make its own food in the absence of sunlight.

Ask the children to prepare two small pots. Let one be filled with coarse sand that has been repeatedly washed. Let the other pot be *filled with ordinary soil. Help them to take two similar plants and plant one in each pot. Help them to observe that the growth of the plant in the pot containing washed sand is not good. The plant in the pot containing ordinary soil grows properly. Point out that the mineral salts present in the soil help the plant to grow well. Help the children to understand that by repeated washing the soluble minerals present in the sand were removed. These minerals are essential for normal plant growth. See Fig.* 7-8.

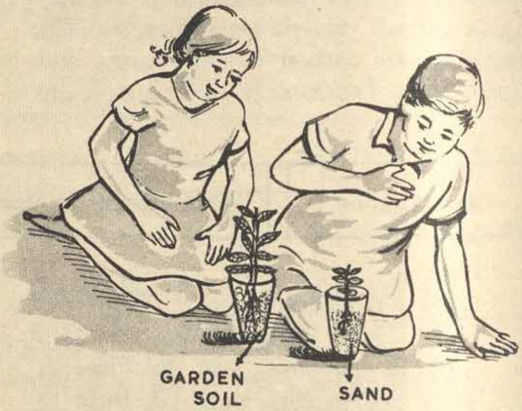


Fig. 7-8
The plant grows better in the garden soil than in sand because the soil has mineral salts required for the plant's growth.

For Better Understanding

Certain parts of plants are green because they contain a green colouring substance called chlorophyll. Chlorophyll is a remarkable substance that helps the plants to manufacture their food materials from simple substances in the presence of sunlight.

Plants are ordinarily seen growing in the soil. Soil itself is not extremely important for the plants. It is the mineral salts present in the soil that are important. The plants make use of these salts for manufacturing the food materials. Scientists have shown that if the various mineral salts are available in sufficient quantities they can grow plants without soil. They prepare a solution of these salts in water. Then they fix the plants in such a way that only the roots are in the solution. These plants grow well and produce fruits.

3(b). NON-GREEN PLANTS DEPEND ON OTHER LIVING OR DEAD THINGS FOR THEIR FOOD

Children are familiar with the idea that green plants prepare their own food. But there are some plants which are not green in colour. These plants cannot manufacture their own food. Such plants include toadstools, mushrooms, and breadmould. The teacher can show these non-green plants to children. These are evidently living things, since they grow and reproduce. These plants grow on other plants or animals. They may grow on living animals or plants, or on dead ones. The following activities may be undertaken to show the children that non-green plants depend for their food on other organisms, dead or alive.

Investigation

How does breadmould grow ?

Materials required
stale bread
hand-lens

Encourage the children to grow breadmould by keeping a piece of stale bread on a piece of moist cloth. Let them watch the white cottony growth. This changes into a black colour after a few days. Point out that these are plants and they get nourishment from the bread. Let the children have a better look with a hand-lens. They will see minute thread-like structures with black swollen parts. Such plants grow on moist bread, old shoes, decaying wood, etc. See Fig. 7-9.

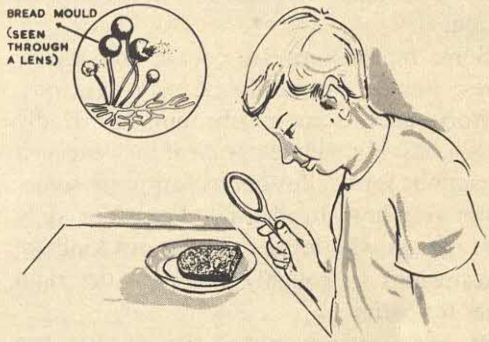


Fig. 7-9
For its growth, the breadmould takes nourishment from the bread.

Teacher Demonstration

What are mushrooms?

Take the children on a field trip after the rains. Show the children mushrooms growing in moist places. Pluck out a mushroom and show it to the children. Show the children non-green plants, such as fungus, growing on decaying wood. See Fig. 7-10.

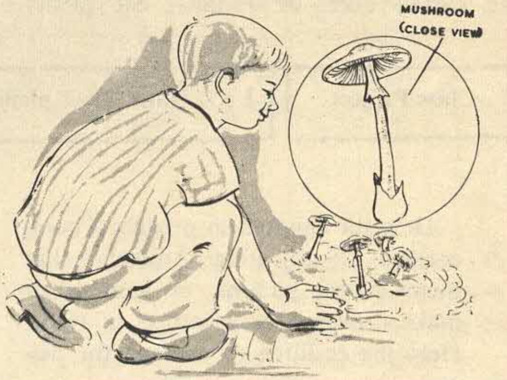


Fig. 7-10
Mushrooms are non-green plants and grow in moist places.

For Better Understanding

The most familiar plants are generally green in colour. Plants differ from animals in their capacity to manufacture their own food. But mushrooms and breadmoulds are non-green and are unable to manufacture their food. Then why are these called plants? Living organisms, whether plants or animals, are all made up of cells. The cells have certain parts like the nucleus, cytoplasm, etc. There is one important difference between a plant cell and an animal cell. A plant cell has a thick covering called the *cell-wall*. An animal cell has a thin covering, called the *cell-membrane*. The cells of all mushrooms, breadmoulds, and the like, have thick cell-walls. Hence they are classified as plants.

Some mushrooms are cooked and eaten. These are considered to be very delicious. Unfortunately some mushrooms are deadly poisonous. Human beings die if they eat such poisonous forms. Poisonous forms are sometimes very hard to identify. Therefore, only that person who knows the various kinds of mushrooms thoroughly can pick the right ones for eating.

3(c). ALL ANIMALS DEPEND ON PLANTS FOR THEIR FOOD

Of all living things, only green plants are capable of manufacturing their own food. Animals are unable to manufacture their food. They depend upon plants and on other animals for their food. Some animals like cattle, deer, or rabbits, eat plants directly. Thus the food manufactured by the plants is utilized as the food of these animals.

Certain animals like wolves, lions, and tigers hunt and eat other animals which live on plant food. If, by some chance, the plants which the animals eat were not available, these animals would die. If this happened then the lions, tigers, and wolves which depend upon these animals would also die. Thus all animals, including man, depend directly or indirectly upon plants for their food.

3(c) (i). SOME ANIMALS EAT PLANTS

Some animals depend for their food on plants alone. Such animals are called *herbivorous* animals. They constitute a major group of animals. Some examples of herbivorous animals are elephants, cattle, deer, and rabbits.

The following activity may be undertaken to show that many animals are herbivorous.

Class Project

Let's learn about plant-eating animals

Materials required
water colours or colour pencils
gum
brushes
picture of animals

Help the children to prepare a book entitled 'Plant-eating Animals.' Let them collect pictures of animals or make drawings or paintings of them. Help the children to arrange the pictures in the book. They can include with their paintings or drawings short descriptions of the food the animals eat.

Encourage the children to feed animals like cows, buffaloes, horses, and rabbits with plant food. Let them observe how these animals feed on plant food.

3(c)(ii). SOME ANIMALES EAT HERBIVOROUS ANIMALS

Children are familiar with animals that eat plants. These plant-eating animals are eaten by certain other animals. Animals that eat other animals are called *carnivorous* animals. Some examples of carnivorous animals are wolves, lions, tigers, leopards, and hyaenas. These wild animals live in forests and hunt animals like deer and goats and wild cattle for food.

With activities like the following, the children may be helped to understand that some animals live on other animals which in turn eat plants.

Field Observation | **What do lions and tigers eat?**

Arrange a visit to a nearby zoo with children—at a time when the lions and tigers are fed. Help them to see how chunks of meat are given to a lion or a tiger and how the animal tears the flesh with its sharp teeth and swallows it. Have children talk with the zoo warden and ask him what kinds of flesh are given to the animals. They will learn that mutton or beef is given to the animals.

Display the pictures of the heads and limbs of carnivorous animals. Discuss with the children as to how the mouth parts are suitable for capturing and eating the animal food. Help the children to compare these with the limbs and mouth parts of plant-eating animals.

3(c) (iii). SOME ANIMALS EAT CARNIVOROUS ANIMALS

Some animals like cranes, ducks and snakes eat frogs and fish. Frogs and some fishes eat small insects and worms. These insects and worms eat plants or their products. Thus, even if an animal eats other animals, the first link in the food chain is a plant. In all cases the plants are directly or indirectly the basic items of food.

The following activities will help the children to understand this sub-concept.

Field Observation | **How do all animals depend on plants?**

Take the children to visit a nearby field and observe the insects eating plants or their products. They can observe these insects being eaten by birds, calotes, frogs, etc. Help the children to realize that all animals ultimately depend upon plants for their food.

Discussion

How do birds help in our food production?

Recall the children's experience of birds eating insects. Draw their attention to the damage caused to cultivated plants by insects. Discuss how birds as a group help in controlling the insects and thus help in increasing our food production. Point out that some birds eat our foodgrains. But the vast majority of birds eat insects.

For Better Understanding

Whales are the largest of the living animals today. They live in the sea. Many of these whales depend upon fish and other sea animals for food. Some of these big fish eat other smaller fish. Some fish feed on plants found in the sea. The fish eaten by the big fish depend either on still smaller fish or plants. These smaller fish in their turn live on minute animals or on plants. The minute animals live on the minute plants of the sea. An important group of plants found in the sea are the *algae*. Among different kinds of algae, one kind is very important from the point of view of food for animals. These are the *diatoms*. These diatoms are very minute plants which can be seen well only with the help of a microscope.

The different animals, including whales, ultimately depend on minute plants in the sea. This shows clearly what is meant by a *food chain*. The beginning of any animal's food chain must be a plant which uses energy from sunlight to manufacture food from simple raw materials. Thus, in the final analysis, all living things get their energy from the sun.

3(d). SOME ANIMALS EAT BOTH PLANTS AND ANIMALS

By now the children are well aware of the various food chains. They also understand that plants are used directly or indirectly as food by animals. Children have learnt that some animals eat only green plants. They have also learnt that some animals prey on other animals, but ultimately animals depend on plants for food. Besides these two types there are some aminals which take both types of food; that is, they eat both plants and animals. These are called *omnivorous* animals. Dogs, cats, bears, crows, and fowls are omnivorous animals. The following activities may be undertaken to help the children to understand that dogs and cats and many other animals including man eat both animals and plants.

Class Project

Let's make an animal book

Materials required
water colours or
colour pencils
brushes
pictures of animals

Encourage the children to prepare an album entitled 'Animals That Eat All Kinds of Food'. The children can paint some animals and their food as well as use the pictures of animals and their food from old books and magazines. Help them to write short notes about the food habits of some animals and include them in the book.

Help the children to observe the food habits of animals such as cats, dogs, crows, and fowls. Discuss how these animals eat both plants and animals.

3(e). MOST FAMILIAR PLANTS CANNOT MOVE FROM PLACE TO PLACE

The children are familiar with a variety of plants. They have seen that plants are fixed to the soil by their roots and they cannot move from place to place. Water plants might appear to be moving from one place to another. But most of these plants do not really *move;* they simply float on water. The current of water carries them from one place to another. Only a few very minute water plants move from place to place by themselves. The ability to move is usually found in animals. With activities like the following, the teacher can help the children to understand that most plants cannot move from place to place.

Investigation

Can plant stems move?

Materials required
bean seedlings
stick

Allow the children to grow some bean seedlings in a pot. Put in a long stick at one edge of the pot. The children will find after a few days that the bean seedlings twine round the stick and go up. Discuss that the stems of bean plants, which are weak, need a support which keeps them erect. Only a part of the plant moves as it twines around the support. The whole plant does not move from one place to another.

Field Observation

To what extent do water plants move?

Arrange a visit with the children to a nearby pond or lake. The children will find water plants like pond-scum, water-hyacinth, and algae floating on the water. Discuss with the children how the water plants move from one place to another. Point out that they depend on the water currents to carry them from place to place.

Let the children keep a potted balsam plant near a window. After a few days it will be seen that the stem has bent towards the source of light. The plant as a whole never moves; it is the parts of plants that show some movement.

For Better Understanding

One of the characteristics of living things is their ability to respond to stimuli. This is absent in non-living objects. All living objects contain a vital material in common, *protoplasm,* which is sensitive to various stimuli such as heat, light, electricity, gravity, or chemicals. Plants or animals or their organs often respond to these stimuli. The ability of plants to receive stimuli or to respond to them is called *irritability*.

3(f). MAN HAS THE CHARACTERISTICS OF AN ANIMAL

Children now understand that animals exhibit certain characteristics which are common to all. All animals need prepared food (since they cannot prepare it themselves); all animals grow; all animals respire; all animals move; all animals have specialized organs; all animals reproduce; and all animals die. The children may be encouraged to compare these functions of animals with those of human beings. They can be helped to conclude that man is also an animal. The following activities may be conducted to demonstrate that man is an animal.

Group Discussion **What kind of food is taken by man?**

Let children discuss the kind of food taken by man. Can human beings prepare food out of simple materials as the plants do? Or do they depend on prepared food of plant or animal origin—like rice, bread, fruits, meat or eggs? What kind of food is taken by, animals such as cows and dogs and cats? Are these foods of animal or plant origin? Help children to understand that many food habits are common to animals and to man.

Group Discussion

Discuss with children the close resemblance between man and monkey. Let them point out the similarities and differences. Discuss the characteristics of living things in which man resembles animals. Discuss mainly the movement, and the dependence on other animals or plants for food.

Scientists at Work

Plant scientists seek ways of controlling diseases of crops

In this class, you have learned about two major kinds of plants. One includes the green plants capable of manufacturing their own food. The other includes non-green plants like mushrooms and breadmould. Breadmould and similar plants live on discarded food, leather, and fabrics. They get their food from the dead things on which they grow.

Some of these non-green plants grow on other living plants. They rob these plants of the food made by them. Such types of living things that depend upon other living organisms are called *parasites*. These non-green plant parasites are of many different kinds and they infect various kinds of plants, called *hosts*.

Man cultivates different crop plants for his food. The non-green plant parasites often infect large numbers of cultivated plants. They decrease the yield from these plants and are thus responsible for decreasing the food resources of man. It is not an easy task to remove these parasites from the host plants. Often they do not grow superficially, they penetrate deep into the body of their hosts.

Early men who cultivated plants must have been baffled to find their plants suddenly getting a disease. They believed so much in superstition that they would have thought that some evil spirit was responsible for the plant diseases. Thus the cause of the disease remained a mystery for a long time. The farmer who was curious tried to find out how the diseases were caused and how they could be prevented. Perhaps he tried, by the trial and error method, extracts from some herbs as drugs for the treatment of the disease. He might or might not have been successful, because his knowledge about the parasites was poor. But such men were responsible for launching the war against these parasites. In the course of time the early scientists found out that such diseases are caused by non-green plants. Today there are scientists all over the world dedicated to the cause of controlling plant diseases. This means more food for man. Through their persistent efforts these scientists have identified various kinds of non-green plants that cause the diseases of cultivated plants. They have found out how the diseases spread from one plant to another. They have tried to develop chemicals to control these parasites. These scientists have not entirely succeeded in controlling all the diseases caused by these parasites. They continue to work ceaselessly to find solutions to many problems. Thus these scientists work for more food for mankind.

Animals as well as plants are often hosts to parasites. The parasites themselves may be plants or animals. Often small animals live as parasites inside the bodies of larger animals. For example, the liver fluke is a parasite in sheep. Certain worms live in the intestinal tracts of many animals. Hookworm and tapeworm are among the parasites which live in man as a host. Doctors of men and of animals are constantly at work to control these and other parasites which infect man.

It is not merely the work of the scientists of today that finds solutions to these problems. The scientists of today derive much from the knowledge gained by the scientists who lived and worked on these problems in the past. The findings of the scientists of the past are available in many books and journals. This information saves a lot of time for the scientists at work today who depend on the work of scientists of earlier years.

UNIT 7

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LIVING THINGS

CLASS IV

Overview

The children in class III have made generalizations about certain characteristics of living things. These generalizations were drawn after observing many different kinds of living things. The children have also learnt that there are differences between plants and animals. But they do not understand the reasons why there is such a variety of living things. In order to understand this, they should understand that plants and animals do not exist in isolation. They live in close association with the environment and with each other. The environment in which the organisms live differs; hence the organisms are also different.

In this class the children are introduced to the different factors that make up different types of environment. Thus the soil, and climatic features like temperature and rainfall constitute the environment in which plants live. These factors often vary from place to place. Only certain plants can adjust themselves to grow in a particular type of surroundings. The major types of environment and their characteristic plants are introduced in this class. Students are helped to survey land and water. The hot and humid places, the cold region, the arid zones and marshy places, and their respective vegetation, are rapidly surveyed. Similarly it is discussed how certain animals are found in cold places while certain other animals are met with in extremely hot and dry places.

Each type of environment has certain unique features. The living organisms that are adapted for particular surroundings survive in that environment. Organisms which are not adapted to their environment perish. The adaptation can be seen well in certain organs. Thus, for example, the long floating stem is an adaptation for plants to live in a dry environment. Similarly those animals that live in cold regions have long, dense hair on their bodies. The animals that live in hot and dry regions have a thick, dry skin. Animals' teeth and limbs are often adapted io capturing and eating food.

The children thus learn that adaptation is a characteristic of living things. The key idea, ADAPTATION, is fundamental to the understanding of the evolution of organisms. The evidence for evolution is based on the diversities of plant and animal life on this earth.

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1. DIFFERENT KINDS OF PLANTS LIVE IN DIFFERENT TYPES OF SURROUNDINGS

On land, plants grow almost everywhere. They are found on plateaus, mountains, deserts, marshy lands, and elsewhere. Every kind of plant requires certain specific conditions for its growth. These conditions include the temperature, the nature of the soil, the amount of water available, and the nature of the climate. These conditions are different in different regions. Therefore, different kinds of plants are found in different regions.

Water plants are of many different kinds depending upon whether the plant grows in running water or still water, in fresh water or salt water, etc.

1(a). SOME PLANTS LIVE ON LAND; OTHERS LIVE IN WATER

The children are familiar with some of the varieties of plants that live on land. Such plants include big trees like the *neem*, the mango, the banyan, and the palm. Examples of smaller land plants are roses, jasmine, brinjal, tomato, grass, wheat, and mushroom.

The children have also seen quite frequently some of the most conspicuous and common water plants. They include the lotus, water-lily, and seaweeds.

With activities such as the following, the children can be helped to understand the two major groups of plants: land plants and water plants.

Field Observation

How can we observe water plants?

Materials required
stick
vessel for collecting water plants

Take the children to a nearby pond. Ask them to line up and stand around the pond. Show them the water plants like the lotus and the water-lily Collect different types of plants available from the shallow region of the pond. Show them to the children. Collect the small and minute plants that float on the pond. Tell the children that these are plants, even though they do not look familiar.

Field Observation

How can we learn about different types of land plants?

Take the children to a nearby garden or field. Encourage them to tell the names of the trees that they see on their way. Draw their attention to different types of plants—tall trees, short trees, small plants with woody stems, small plants with weak stems. Discuss these plants, that they see, during the first part of the trip and help them to review this information on the way back.

Collect different types of weak-stemmed plants, creeping plants, climbing plants.

Class Project | **Let's prepare a picture book of water plants**

Materials required
pictures of aquatic plants
aquatic plants
water colours
brushes

Encourage children to collect pictures of aquatic plants or to draw some of their school aquarium plants for a small picture book entitled 'Aquatic Plants'. Help them to write a short description of each plant.

For Better Understanding

Flowering plants may be trees, shrubs or herbs. Everybody is familiar with trees. Shrubs are plants that have a small bushy growth and woody stems. Roses and hedge plants are examples of shrubs. Herbs are soft and weak-stemmed plants.

There are different kinds of weak-stemmed plants. Some twine around a support. Such plants are called *twiners*. A familiar example is the bean plant. Some plants climb the support with the help of tendrils. These are called *climbers*. A good example is the pea plant.

1(b). CERTAIN PLANTS GROW ONLY WHERE IT IS HOT AND HUMID

Ours is mainly a hot country. It is surrounded by the sea on three sides. Humidity is very high in regions adjacent to the sea. Plants like pepper and rubber grow in these hot and humid regions.

The activities mentioned below can help the children to learn that some plants grow in hot and humid places.

Group Discussion | **Which plants grow in hot, humid regions?**

Discuss with the children that certain plants like rubber and pepper grow only in places which are hot and humid. Rubber and pepper are grown in Kerala where the conditions are favourable for the growth of these plants. Show the children pictures of pepper and rubber plants.

1(c). CERTAIN PLANTS GROW ONLY IN COLD REGIONS

The mountains and hills are cooler than the other places in our country. Some children might be familiar with this since some people go to hill stations during the summer months. The coolness of a region helps certain plants to grow. Cone-bearing trees, coffee, and tea grow well in these cool regions.

Activities such as the following can help the children to undersland that certain plants grow best in the cooler regions.

Class Project

Let's learn about plant life in cold regions

Materials required
pictures of vegetation in cold regions

Show the children plants like coniferous trees that grow in cold regions. In places where it is impossible to see these plants the following activity may be undertaken.

Collect pictures of trees that grow in cold regions. Display the pictures on a board and exhibit them in the class. Discuss with children the nature of these trees, the places where these are found in India. If possible, obtain from a nearby college herbarium specimens of plants that grow in cold regions. Exhibit them in the class.

Ask children when they go to a hill station to collect small twigs with leaves of plants that grow in cold regions and to dry the specimens by pressing them between papers. Show these to the other children. Ask them also to collect dry cones and pine needles and to bring them to the class.

1(d). CERTAIN PLANTS GROW ONLY IN ARID REGIONS

Some regions are hot and dry. Water is scarce in such regions. In these places many kinds of plants do not grow. Only a few kinds of plants that can bear extremely dry and hot conditions survive there. Different kinds of the cactus plant are common in such regions.

With activities such as the following, the teacher can help the children to understand that in arid regions only a few special types of plants grow well.

Class Project

Let's learn about the plants that grow in arid regions

Materials required
pictures of the desert
specimens of plants that grow in a hot and dry region

Collect pictures of the vegetation of the desert regions. Neatly label them and add some self-explanatory notes. Display these on the board in the class. Discuss with children the occurrence of some desert plants like prickly pear and other cacti in the neighbourhood of the school. Tell them that these plants can survive in places which are dry and do not have much water.

Encourage the children to collect some cactus plants and grow them in the 'nature corner'. Help them to find out that unlike other plants, cactus plants can live with little water. Ask the children to observe these plants thriving well in areas where conditions are dry.

For Better Understanding

A 'Nature Corner' is a small area set apart in the school for the children to grow plants and animals and observe them. It need not be an expensive arrangement. A few pots of indoor plants, an aquarium tank or any wide-mouthed bottle or battery jar for keeping fishes, and perhaps one or two cages for birds will do for a modest beginning. The entire management should be left in the hands of the children. The teacher should give them guidance now and then. Many items required for the Nature Corner can be improvised out of the useless junk materials. Once the children are drawn into this, they will develop interest and will actively participate in maintaining and improving the Nature Corner.

1(e). CERTAIN PLANTS GROW ON MARSHY LAND

Marshy areas are soaked with stagnant water. The soil is very clayey. Ordinary land plants cannot survive there. They will rot and die. Certain weeds and special types of grasses grow very well there. Through the following activities the children can be helped to realize that only certain kinds of plants grow well in marshy lands.

Field Observation

What is the vegetation like on marshy land?

Take the children on a field trip to a nearby marshy place. Draw their attention to the peculiar odour of the place. (This is due to the rotting of the leaves.) Help the children to observe the nature of the soil. It is clayey, water-logged and black in colour. Point out the nature of the vegetation. Let them see that the plants found there are unique and are absent in other kinds of environment.

Collect the respiratory root of Avicennia, *and the germinating seeds of* Rhizophora *while they are still attached to the mother plant. Discuss that the absence of a sufficient amount of oxygen in the* *clayey soil of marshy plants has caused these plants to adapt themselves to get a sufficient amount of oxygen.*

For Batter Understanding

The soil of the marshy regions is clayey and water-soaked. All parts of a plant require oxygen for respiration. The wet, clayey soil does not hold enough air for respiration. Therefore, some plants like *Avicennia* send up special roots called respiratory roots. They have pores at the top through which the exchange of oxygen and carbon dioxide takes place.

Rhizophora is another plant of marshy places. In its fruit there are seeds which germinate while still remaining on the plant. If the seed should fall in the marshy soil it might not get a sufficient amount of oxygen to germinate. After it has germinated on the parent plant, the young seedling falls on the soil and grows into a mature plant.

2. PLANTS HAVE SPECIAL CHARACTERISTICS WHICH ADAPT THEM TO THEIR SURROUNDINGS

The children have seen that the environments in which the plants live are of different types. The nature of the soil, the temperature, rainfall, and other physical factors make up different types of surroundings. To thrive well in a particular surrounding, the plants must find the environment suitable and have certain special characteristics. In other words the plants which survive are adapted to their environment.

2(a). CERTAIN WATER PLANTS POSSESS STRUCTURES WHICH MAKE THEM FLOAT

Water plants are of two types. One type remains fixed to the soil by its roots. The other type remains floating. Some examples of floating plants are *Pistia, Jussiaea, Lemna, Wolffia,* and water hyacinth. *Lemna* and *Wolffia* are minute plants which float on the water. In *Jussiaea* some of the side roots are modified into white spongy structures. This helps the plant keep afloat. In water hyacinth, the leaf-stalks have bulb-like swellings filled with air. Thus, different kinds of plants are adapted in different ways for floating in water.

Help the children to learn through the following activities that certain plants are adapted for floating in water.

Demonstration

How are some aquatic plants adapted for floating?

Materials required
different kinds of
floating water plants
basin
scalpal or used blade

Obtain some floating water plants like *Pistia, Jussiaea, Lemna, Wolffia,* and water hyacinth. Float them either in a basin of water or in any water tank. Take one kind of plant at a time and discuss how it is fitted for floating in water.

Encourage the students to grow some small floating water plants in their nature corner.

2(b). THE STEMS OF SOME WATER PLANTS ARE ELONGATED AND THUS KEEP THEIR LEAVES ABOVE WATER

Some water plants that remain fixed in the soil remain submerged in the water. Water plants like *Hydrilla* and *Vallisneria* are of this kind. Some water plants, though fixed to the soil, keep their leaves floating above the water. Lotus and water-lily are examples of such plants.

With activities such as the following, help the children to understand that certain water plants have long stems and therefore their leaves float on the surface of the water.

Demonstration

How are the lotus and water-lily plants adapted for living in water?

Obtain either a lotus or a water-lily plant with its root. Show the children its root, long stems, and leaves. Contrast its stem with that of the water plants that float wholly on water. Draw the children's attention to the long stem in the lotus or water-lily. Point out how these stems can bend in different directions without getting broken. Contrast this stem with the rigid and less flexible stems of land plants.

Encourage the children to measure the length of a stem of a lotus or a water-lily. Help them take a transverse section of a lotus or water-lily stem and one of a land plant. Help them to find the difference between these two. Show the presence of air spaces inside the stem of water-lily and lotus. Discuss how this makes the plant lighter and helps its leaves remain on the water's surface. The air in these air spaces is also useful to the plant for aeration.

For Better Understanding

Plants, at living organisms, respire. Submerged aquatic plants use the oxygen dissolved in water. The water-lily and the lotus which have their leaves exposed to the atmosphere use atmospheric oxygen. The leaves of these plants have small pores called stomala (singular : stoma). These are distributed mostly on the upper surface. The leaves have a wax-like substance on them. This prevents the water from sticking to the leaves.

2(c). PLANT LEAVES ARE SO ARRANGED THAT THEY CATCH THE MAXIMUM AMOUNT OF SUNLIGHT

Plants, as children know, have the ability to manufacture food from inorganic sources. They obtain minerals and water from the soil and carbon dioxide from air. From these they produce starch in their green leaves in the presence of sunlight. Sunlight is essential to the green plants for the manufacture of food. The structure of plants is adapted for getting the maximum amount of sunlight. This is achieved by the arrangement of the leaves. The arrangement enables the leaves to be exposed as fully as possible to sunlight. If the leaves of a plant are improperly arranged, some leaves hide the other leaves and thereby prevent them from being exposed to sunlight.

With activities like the following the children can be helped to understand that arrangement of leaves, their size, and their shape are such as to catch the maximum amount of sunlight.

Investigation

How are leaves arranged?

Materials required
sunflower twig
Calotropis twig

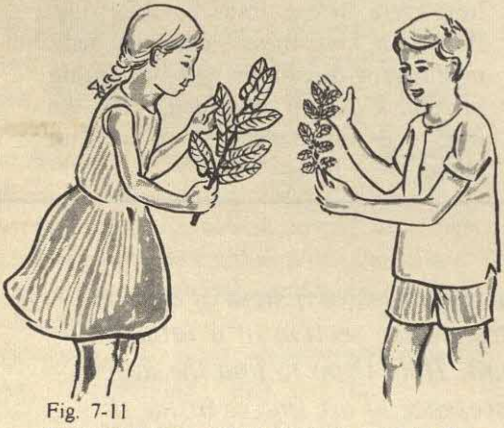

Fig. 7-11
Leaves are arranged in opposite pairs in *Calotropis* plant.

Encourage the children to collect a sunflower twig, and a *Calotropis* twig. Let them see the leaf arrangements on the stem. It will be seen that the sunflower leaves are arranged alternately. In the *Calotropis* plant, the leaves are arranged in opposite pairs as in Fig. 7-11. No pair of leaves is arranged just over the other below it. These examples show how leaves are arranged so that a plant is able to catch the maximum sunlight most efficiently.

Investigation

How does the arrangement of leaves in acalypha provide maximum sunlight?

Material required
Acalypha plant

Obtain an *Acalypha* plant or any other plant that shows the leaf arrangement as shown in the figure. Help the children to observe that the leaves are crowded at the top, but each leaf is well exposed to the sunlight. Some leaves have long petioles; therefore, they stretch far away. These leaves

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are large. Some other leaves have smaller petioles. These lie in the space available between the big leaves. Since the available space is less the leaves are small. Their small size and short petioles enable them to be exposed fully to the sun. Encourage the students to obtain other plants that show a similar arrangement of leaves. This arrangement is called *leaf mosaic*.

Encourage the children to obtain the top portion of an Acalypha *plant. Let them prepare a herbarium specimen by pressing it and drying it. Help them to prepare the specimen in such a way that the arrangement of the leaves to get the maximum sunlight is clearly shown.*

Encourage the children to draw and paint the top portion of an Acalypha *plant showing the peculiar arrangement of leaves to catch maximum sunlight.*

2(d). PLANTS WHICH LIVE IN ARID AREAS HAVE SMALL OR THICK LEAVES

In arid areas, water is scarce and the soil is frequently sandy. Sand cannot retain or hold water. The extreme heat evaporates the water rapidly. The children know that certain kinds of plants grow in sandy and arid areas. Such plants have special structures which help them to prevent a rapid loss of water. These include prickly pear, *Casuarina,* and cactus. Water escapes through the leaves of plants. But in plants of the arid regions. the leaves are reduced in size. Often they are simple spines. Prickly pear has no normal leaves. Its stem is flat and green. Food is manufactured here rather than in the leaves. The flattened stem has a waxy substance on its outside which prevents rapid evaporation. The flattened stem is thick and juicy and stores water. Another example of a plant with thick leaves is *Agave*. This plant also preserves water inside its thick leaves. With suitable activities, children may be helped to appreciate that plants growing in arid areas have modified leaves and stems to prevent evaporation and to store water.

Demonstration

What is the nature of leaves and stems in desert plants?

Materials required
different kinds of plants of arid regions
mounted needles

Collect specimens of plants that grow in arid regions—prickly pear, *Agave,* cactus, and *Casuarina*. Show the children the thick leaves in *Agave*. Point out the presence of spines in prickly pear and in cactus plants. Tell them that these plants have no normal leaves. The leaves are present as spines. The spines help protect the plant against being eaten by desert animals. But there must be some green part in the plant where it can manufacture food. This place is the stem which is not green in many plants. Point out the minute scales in *Casuarina* at the joints of the green stem. Discuss that these are the leaves. The green part is the stem.

Investigation

Through which part of a plant does water escape?

Materials required
glass tumblers
cardboards
cotton
seedlings

Pour water in each of two glass tumblers. Pass the root of each of two similar seedlings through a hole in a piece of cardboard. Plug the hole with cotton. Leave one seedling as such and cover it with a glass jar. Remove the leaves from the other seedling. Cover it with another glass jar. Or, an arrangement like that in Fig. 7-12 may be made. The only difference between the two seedlings is that one is without leaves. Leave them in sunlight for some time. Help the children to observe the presence of droplets of water in the jar containing the seedling with leaves. Help them to conclude that water escapes through the leaves as water vapour.

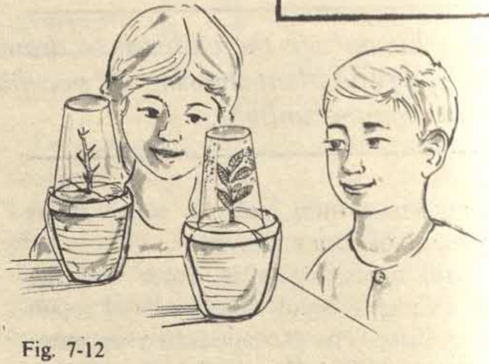
Fig. 7-12
In plants, water escapes through the leaves as water vapour.

Investigation

Why do desert plants have thick leaves and a waxy coating?

Materials required
leaves, thick and thin
thread
vaseline

Collect some thick leaves and some thin leaves of any kind. Suspend the leaves from a thread. Leave them in the sunlight. Which of the two kinds—thin or thick—wilt sooner? Discuss with the children how the thin leaves quickly lose their water, and wilt Thick leaves contain more water and last longer.

Take some leaves from any plant.

Apply vaseline on the surface of some of the leaves. Leave other leaves without the vaseline. Expose all the leaves to sunlight as before. Let the children find out which of these leaves wilt more quickly. Help them to realize that the coating of vaseline prevents water from escaping.

For Better Understanding

Spines or thorns are found in many plants. In many cacti, such as prickly pear, the leaves are reduced to the form of spines. Small structures may be termed *spines*, but the larger structures are usually referred to as *thorns*. In some plants the axillary bud (the bud present in the axil of a leaf) is modified as the thorn. In certain other plants the part found at the base of the petiole may be modified as a thorn. Thus the modifications differ in different plants.

2(e). THE ROOTS OF PLANTS ARE ARRANGED TO ABSORB WATER

Roots are the organs of absorption of water and nutrients or mineral salts dissolved in the water of the soil. These materials are transported from the roots to the green parts of the plant. Using energy from sunlight, the green parts manufacture the food out of these mineral salts, water, and carbon dioxide.

Since the soil is the source of supply of the mineral salts and water, the roots must be in intimate contact with it. The root divides into very many branches which penetrate into the soil in search of water and mineral salts.

The activities given below will help the children to realize that roots are arranged to absorb water and mineral salts.

Field Observation

How are the roots of a plant arranged?

Uproot any small plant. Show the children its root system. Help them to see how the root is divided into minute branches. These branches are in close contact with soil.

Investigation

How can we show that roots absorb water?

Materials required
test-tubes
cotton
coconut oil
seedling

Place a healthy plant in water in a test-tube. Mark the water level. Pour water in another test-tube to the same level and mark it. Add a few drops of oil to each tube to prevent the water from evaporating. Lightly plug each test-tube with cotton. Show the children that after a day there is a decrease in the level of water in the test-tube containing the plant. Let them see that there is no decrease in the level of water in the other tube. Discuss that since there is oil in each tube the water could not have evaporated. The root of the plant is in contact with the water and must have absorbed some of it. See Fig. 7-13.

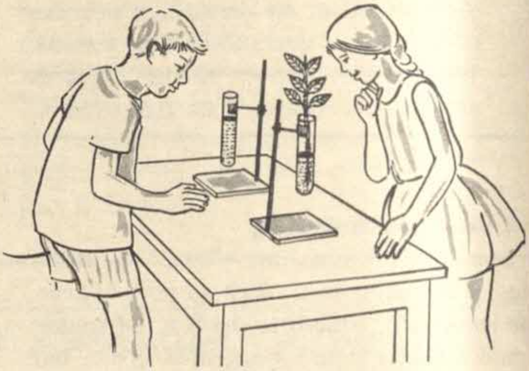

Fig. 7-13
The roots absorb water in plants.

Investigation

How are dissolved substances absorbed by roots?

Materials required
bottle
red ink
balsam plant

Pour water in a bottle. Put in a few drops of red ink. Wash the roots of a balsam plant. Ask the children to notice the colour of its stem. Put the plant in the bottle. Leave it for a few hours in sunlight. Show the children that the stems are now coloured red. Help them to realize that the roots absorb the substances dissolved in water.

Investigation

How much mineral matter is dissolved in water?

Materials required
tumblers
soil water
rain water

Take some soil and put it in a glass tumbler. Pour in some rain water and shake it well. Allow it to settle for some time. Take the clear water and evaporate it. Show the children that some white substance (salts) is left behind. Tell them that the salts from the soil were dissolved in the water. Evaporate some rain water and show that it contains very little dissolved material.

For Better Understanding

Rain water can be collected in a clean vessel after a shower. However, the first shower might be contaminated with dust. The rain water should be directly collected in the vessel. The water that runs down the roofs of building often contains some dissolved substances. If available, distilled water can also be used. Pure rain water has almost no salts dissolved in it.

3. ANIMALS LIVE IN DIFFERENT TYPES OF SURROUNDINGS

Animals are of different varieties. Some of them live in water, some on land. Some live partly in land, partly in water. There are small insects like ants, flies, and butterflies; there are land and water birds, there are snails and earthworms; there are domesticated animals like cows, buffaloes, and dogs; there are snakes; there are large animals like elephants and rhinoceros, and huge animals of the sea like whales or giant squids. Not all the animals, however, live at one place or in the same kind of habitat. Different kinds of animals live in different surroundings. Animals are adapted to a certain kind of environment. They thrive best under those conditions. The skin is a good example of adaptation to various kinds of environmental conditions.

3(a). SOME ANIMALS LIVE IN HOT REGIONS; SOME LIVE IN COLD REGIONS

Many animals live in hot regions only. Thus many scorpions, spiders, centipedes, millipedes, and so on, live in extremely hot regions. Other animals, like snakes and lizards also abound in hot regions. Among larger animals, desert foxes, domesticated camels, and goats can tolerate extreme heat.

Compared to very hot places, there are other areas which show a very cold climate. The snow-clad mountains and the Arctic and Antarctic regions of the earth are examples of such extremely cold places. Only certain animals can live in the cold regions. Such animals are some fish, seals, etc. A few birds, like penguins, can stay in cold weather. Mammals such as the polar bear, seal and walrus thrive in cold regions. The children can be helped to understand that some animals live in a hot climate and some live in a cold climate through the following activities.

Class Project

What animals live in regions of extreme heat and cold?

Materials required
pictures of animals
card box
gum

Collect pictures of some animals like camels, spiny lizards, turtles, and snakes, that live in extremely hot regions, and also of penguins, polar bears, seals, and walruses. Display these pictures and give a short account of the life of these animals.

Arrange a visit to the nearby zoo. Let the children see the animals that live in very hot regions. Also show them the animals of the cold countries kept in the artificially cooled rooms.

3((b). SOME ANIMALS LIVE IN HOLES IN THE GROUND

Animals like termites, ants, crabs, rats, and snakes live in holes. These animals are often found in hot regions. But they avoid the heat of the sun during the day. They remain inside the burrows during the day and come out of the holes during the night.

The following activities will help the children to understand that some animals avoid the heat by remaining underground.

Discussion

Why do some animals live in holes?

Mention the names of animals that live in burrows or other underground places. These include rabbits, ants, termites, crabs, and snakes. Discuss that these animals cannot bear extreme heat. They come out of the burrows during the night, when the surroundings are somewhat cooler than during the day.

Show the children pictures of the holes in which the animals live. Models of holes are shown in some museums. Take the children on a visit to the museum, if possible.

3(c). THE SKIN OF ANIMALS IS ADAPTED TO THE TEMPERATURE RANGE AND ENVIRONMENT IN WHICH THEY LIVE

Children know that different animals live in different types of environment. The skin, the outer covering of the animals, is adapted to the surrounding conditions. Animals living in hot and dry regions often develop a thick skin which does not permit excessive evaporation of water or penetration of heat into the interior of the body. Animals of the colder regions, on the contrary, develop a glossy skin, beneath which a layer of fatty tissue develops. Sometimes they have long dense hair which prevents heat escaping from the body easily. The seals, polar bears, yaks, and Himalayan rabbits illustrate one or both of the above devices which help these animals to live in colder areas. With activities such as the following, it will be possible for the children to learn that the skin of the animals plays an important role in enabling them to live in particular conditions.

Discussion

How is a rabbit or polar bear adapted for living in cold regions?

Collect pictures of fur-bearing animals which live in cold regions. Let students see the Himalayan rabbits, the yaks, and the polar bears. They will find that all three animals have a very thick coat of hair. Help the children to understand that the hair traps air and thus the body heat is not allowed to escape quickly.

Discussion

How is the skin of the camel adapted to a hot dry region?

Allow the children to talk to a camel driver and a cobbler. The children will learn that the skin of the camel is very tough and has a fine coat of hair. Camels have little hair, but they have a tough skin to help them survive in the very high heat of the desert.

3(d). THE SKIN OF ANIMALS PROTECTS THEM FROM EXTREME DRYNESS

The skin is the outer covering of the body. The skin protects the tender internal organs which lie under it. Children know that different animals have different kinds of skins, depending on where the animals live. If the animals belong to a warmer region, the skin is tough and less hairy. But animals living in a colder area often have a smooth, oily skin covered with dense hair.

In the case of animals living in water, there is a variation in the appearance of the skin. Crocodiles living in warmer water have thick skins. Seals living in polar regions have thin, glossy skins. But below the thin skin there is often a thick layer of fat which keeps their bodies warm. The purpose of the skin, whether thick or thin, whether covered with more or less hair, is to protect the internal organs and prevent too much loss of water. Children may be permitted to undertake suitable activities such as the following to demonstrate that the skin prevents excess evaporation of water from the body.

Discussion

How do animals' skins reduce evaporation?

Permit the children to talk to a camel driver or to a shepherd. Let them listen to the stories about these animals drinking water from rivers or ponds and then grazing for hours, even days, without drinking any more water. The skins of these animals are thick and prevent excess evaporation of water. Hence the small amount of water which these animals take in is retained in the body. This permits the animals to remain alive and active.

Discussion

How does our skin help to maintain body temperature?

Recall children's experience of excessive sweating on a hot day. Discuss how the skin secretes water, and the evaporation of the water causes a feeling of coolness. During cold days we do not sweat so much.

Investigation

How does evaporation affect temperature?

Materials required
two metal vessels
cloth

Put water in two similar metal vessels. Wrap one of the tumblers with a damp cloth and periodically moisten it. Keep the other vessel covered with dry cloth. Cover both the tumblers with a piece of cardboard. After some time note the temperature of the water in each. The temperature of water in the vessel covered with the damp cloth is lower. Discuss how the evaporation of water has caused coolness. See Fig. 7-14.

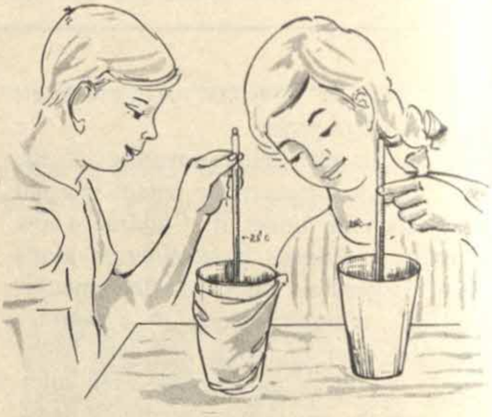

Fig. 7-14
Evaporation of water from the wet cloth lowers the temperature of the water.

Interview

How does moist skin affect our temperature?

Encourage the children to ask their mothers why they insist that after a bath the hair should be carefully dried with a towel, lest the children catch cold. If the hair remains wet it may cool the scalp quickly. That is why one may catch cold.

For Better Understanding

In higher animals and man, the skin plays a large part in controlling the amount of water retained in the body. Although kidneys control the water regulation, the role of the skin is also important. For the human body, even on a day when the temperature is not very high, the skin eliminates about a pint of water through perspiration. On a hot day, the skin may eliminate three quarts of water. As the water evaporates it helps to cool the body.

The skin does not eliminate water alone. It also eliminates certain salts. That is why perspiration has a salty taste.

The skin also saves water by providing a waterproof surface over the body. The same covering also helps in keeping bacteria, moulds and other infectious agents from coming in contact with tissues within. Also, the skin has thousands of sensitive spots embedded in it. These make one sensitive to heat, cold, pressure, and pain.

During hot weather the skin sweats more. The evaporation of the sweat helps the body to remain cool. During hot weather waste materials from the body are eliminated mainly through sweat. Therefore, one does not pass much urine. On a cold day less sweat escapes, since there is no need to keep the body cool. On such days waste materials are eliminated through urine. Hence one passes more urine on cold days.

4. ANIMALS ARE EQUIPPED TO SECURE THE FOOD THEY EAT

Animals differ in their food habits. Some animals catch other animals and eat them. Certain animals eat grass and other plants. Some of the animals' organs are modified and adapted for the type of food animals eat. The organs that help them in obtaining food are the mouth and the limbs of animals.

4(a). SOME BIRDS HAVE HARD BEAKS

Birds feed on grains, seeds, fruits, insects or small fish, frogs, worms and caterpillars. The water birds like ducks and swans find their food in water and gobble their food along with water. Birds like cranes or herons remain in shallow water. When they see some fish approaching, they capture it with their long beaks. Eagles capture the animals dead or alive, tear the flesh and eat them. Sparrows and pigeons feed on grains. Parrots have hard stout beaks to crush fruits or crack nuts. But one thing that all birds have is a beak. The beak helps a bird to pierce and tear the food apart in small pieces and then swallow it. Beaks are made up of hard, horny structures. Thus the structure of a beak is adapted to the food habits of the bird. The children may be encouraged to perform the following activities to help them to understand that the beak of a bird is a hard structure which helps it to catch its food and eat it.

Field Observation | **How do woodpeckers eat?**

Encourage the children to go out in the field and see how woodpeckers drill the bark of trees in search of insects. Help children to see that the woodpecker has a strong beak which helps it to strike hard at the tree bark. This produces a characteristic sound. The wood is torn open and the food is captured.

Help children to see actual specimens or pictures of different types of beaks of birds. Discuss how the beaks are adapted for the type of food they eat.

4(b). THE MOUTH PARTS OF DIFFERENT ANIMALS ARE ADAPTED TO THEIR FOOD HABITS

The mouth is the principal organ for eating. In many animals it is also primarily concerned with catching food. There are many different parts in the mouth. The tongue, the teeth, and the jaws are modified in different animals to enable them to eat different kinds of food. Thus cows, buffaloes, and horses have stout, flat teeth for grinding and eating plants. Animals like tigers, wolves, lions, dogs, and cats have strong, sharp teeth for tearing the flesh of the animals they eat. The tongue of the frog is used for capturing insects; it is sticky. Snakes that swallow animals whole have jaws capable of distending. Rats and squirrels have four prominent front teeth. These help in gnawing grains and other hard foods.

The following activities can help the children to understand that the mouth parts of animals are fitted for the type of food they eat.

Discussion

How are the mouths of animals adapted to their food habits?

Materials required
pictures of animals

Collect pictures of the mouths of the following animals: cow, horse, cat, tiger, rat, and squirrel. Obtain pictures of a frog and a chameleon showing its tongue as an organ for capturing its prey. Show the children a picture of the highly extendible jaws of snakes.

Discuss with the help of these pictures how the mouth parts in different animals are suited to the kind of food they capture and eat.

Field Observation

How do the mouths of animals differ?

Help the children to see the inside of the mouth and the teeth of a horse, a cow, and a dog with the assistance of the animal keepers in a veterinary hospital. Similarly help them to see the mouth of a snake with the assistance of a snake charmer. The children can be encouraged to observe for themselves the mouths of certain harmless animals like rabbits and frogs.

Obtain any two types of fishes. One type should be like the murrel that eats other fishes. The other type may be any carp that eats minute organisms. Show the children that the mouth of a murrel is large, with small teeth to prevent the escape of its prey. Let them contrast this to the small mouth of a carp adapted for eating suspended matter and minute organisms.

For Better Understanding

Different kinds of animals have different number of teeth. The front teeth are called *incisors*. These are prominently seen in rats, rabbits and squirrels. These are useful for chiselling or gnawing. Arranged next to the incisors are the *canine* teeth. The canine teeth are well developed in flesh-eating animals. The large, long teeth seen in lions, tigers, dogs, and cats are canine teeth. These teeth are useful for tearing flesh. The teeth behind the canines are the *premolar* teeth. These are followed by the *molar* teeth. These molar teeth are flat and stout and are well developed in animals that chew the cud. Examples of such animals are cows, buffaloes, etc.

Some fishes and snakes have teeth. These are not useful for cutting or grinding the food. They prevent the captured food from escaping. Turtles have a cutting plate instead of teeth.

4(c). THE LIMBS OF MANY ANIMALS ARE SHAPED ACCORDING TO THEIR FOOD-CAPTURING HABITS

The limbs of animals are often adapted to their food habits. Carnivorous animals like tigers, lions, cats have claws in their limbs. This helps them to chase their prey and catch it firmly. Eagles and owls have clawed feet to hold the animals on which they feed.

The children can be helped to learn through the following activities that the limbs of many animals are adapted for capturing the food on which they live.

Group Discussion

How are the limbs of flesh-eating animals adapted for capturing their food?

Help the children to observe the feet of a cat. Discuss how the soft, cushioned feet help the animals to follow the prey noislessly. Show the presence of claws and discuss how these help the animal to capture its prey and hold it. Encourage the children to think of other animals that feed on flesh and discuss the nature of their feet.

- *Show the children pictures of birds whose legs are useful for* *capturing their food. Let them recall how the front limbs are modified in monkeys for collecting the food items on which they feed.*

Scientists at Work

You have learnt that plants and animals live in many different types of regions. In each type of environment, only certain animals and plants are adapted to thrive. The plants that are not adapted to the environment cannot survive there. For example, if a plant is to thrive well in a desert, it should have small, thick leaves to reduce the escape of water. If you introduce a plant with big, thin leaves in a desert, the plant will loose much of its water through its leaves. It will wilt and die.

Animals and plants have been living on this earth for many millions of years. How do we know? Scientists constantly find parts of animals and plants. They do not appear as they appear in organisms today. They appear like stones. These are called *fossils*. Any permanent evidence of the existence of past life is a fossil. A fossil may be either a plant or animal or its parts or its impression like the footprint. Very often the hard parts of organisms like the shell or the skeleton are found as fossils. The soft parts have decayed in the course of time. The organic materials are replaced by the inorganic salts. Therefore, the fossils give the appearance of stones. Occasionally insects embedded in amber, or whole animals nicely preserved in ice, are discovered.

The scientists who are engaged in working with fossils are known as *palaeontologists*. They often find only parts of animals or plants. They reconstruct the models of animals from the evidence they have collected. They analyse the matter of which the fossils were made and estimate the time when these animals lived. Often the time period is millions of years. From the evidence collected, the scientists have descriptions of animals and plants that lived during different periods. Many of those animals are not alive today. They are said to be *extinct*.

There were once huge reptiles, many times bigger than elephants. A few mammals were found only during the last part of the Age of Reptiles. So scientists inferred that mammals developed later than the reptiles did. The fossils of man are found in rocks that are considered by the scientists to be very recent compared to the age of the earth.

Palaeontologists believe that the animals and plants that were not adapted to the surrounding died out. As the environment gradually changed, some animals died out and others thrived and took their place. Thus many animals found during ancient times are not alive today. The present-day forms have evolved from the prehistoric forms. Thus animal life is always undergoing change. This change is very slow and cannot be seen within the life span of a single organism. All such changes accumulate during the course of millions of years and new types of organisms evolve. Scientists call this the *process of evolution*. Evolution is not fiction. The concept of evolution is based on the evidence collected by the scientists. The first scientist who developed a satisfactory explanation of evolution was Charles Darwin—a British biologist.

Charles Darwin was born in the year 1809. His father wanted him to become a doctor. When he found that his son was not interested in the study of medicine, he wanted him to become a clergyman. Charles Darwin's interests were in biology.

He was not considered brilliant by his school teachers. All the interests of his boyhood were in collections and shooting. He made collections of shells, pebbles, stamps, insects and birds' eggs. Even after obtaining his bachelor's degree from Cambridge, his interest in collections of specimens continued.

He joined the voyage on board the vessel *Beagle*. The voyage lasted for five years. During his voyage around the world he made many interesting collections of animals and plants. He also had opportunities to observe nature and living creatures. He carefully recorded all his observations.

During his voyage, he visited the Galapagos Islands. These are groups of islands situated several hundred kilometres west of South America. The birds of these islands, called 'finches', attracted his attention. These birds were very much different from the finches found on the mainland. All these birds resembled one another very closely except for their size, their food habits and in the nature of their beaks. From the evidence available, he inferred that these different kinds of birds might have descended from one common type of bird of the past.

After returning home, he wrote about the conclusions he had reached. He thought that animals and plants change and evolve into new ones. He published his findings in a book titled *The Origin of Species*. All the books were sold in a single day.

Darwin died in 1882. But his contribution to science is very much alive amidst us today.

UNIT 8

PLANT LIFE

CLASS I

Overview

Man is a living thing in a world of other living and non-living things. The plant kingdom makes up a very large and very important section of living things. No matter where or how one lives, one is surrounded by many kinds of plant life, wild and domestic, ranging from microscopic bacteria to gigantic trees. Small children are not only familiar with plants of many kinds—they are also very much interested in them. Accordingly, it is in order for children from class I to begin a year-by-year study of plant life.

The major concepts involved at this class level are simple but important. One of these is that in plant life, as in so many other segments of man's surroundings, there is *great variety*. Plants vary widely in size, shape, structure, colour, growth habits, and in other ways. Young children can be helped to recognize this variety, and to accept it.

Yet, in spite of the great *variety* in plant life, there is a degree of *similarity* among most plants. Green plants are able to manufacture their own food from simple substances. Familiar plants are stationary; they are unable to move from place to place. Many common plants grow from seeds. It is this last point of similarity which is considered at this class level.

Plants are not only interesting—they are also extremely useful to man. They supply man with many food materials. They provide building materials, textile fibres, drugs and medicines, fuels—and beauty.

Children should have an opportunity to learn about plant life in relation to man and other animals, and in relation to the weather, soil and water and other non-living materials. They should learn well a few simple and important concepts but should not be burdened with meaningless identification and memorization. In this way they can begin to understand plant life as a part of the world which is not only interesting and important, but is also pleasant and satisfying.

1. THERE ARE MANY DIFFERENT VARIETIES OF PLANTS

Almost everywhere one turns, one finds many kinds of plants—big, medium, and small. Quite often children consider the big green trees or bushes as the only plants, and may not know that algae and moulds are also plants. In homes and in courtyards, there may be potted and ornamental plants or perhaps a patch of green grass. Along the roads, in the fields, over the surface of a stagnant pool of water, there are plants of various sizes and shapes. Almost all familiar plants are green; this helps them to manufacture their own food. But some plants are not green, as for example, bacteria on wet moulds or mushrooms which grow on wet shoes, stale bread, or wet, decaying wood. There are plants that are visible to the naked eye; there are others which are very small and can be seen only when magnified through a microscope.

Thus there exists a great variety of plant forms, which small children should be encouraged to understand. The task of the teacher is to encourage the children to appreciate the vast variety in plant life.

1(a). PLANTS DIFFER IN SIZE

Plants vary widely in size. There are tall trees and small bushes. Again, different kinds of trees grow to different heights. Shrubs and bushes grow less tall than trees. There are creepers which grow to great lengths. Other plants are tiny. There are water plants and sweeds—some are big and long while others are small. The simple plants—like algae—may be so small that they can only be seen through powerful microscopes. Yet some algae grow into giant seaweeds. Here are some simple activities which can help the children to appreciate the great variety in the size of plants.

Field Observation

How many varieties of plants can we find?

Invite children to join in an excursion in a garden near the school. Have them observe trees, bushes, shrubs, creepers and water plants. Help them realize that there are wide variations in the sizes of different plants.

Investigation

How can we compare and preserve plants?

Materials required
old newspaper sheets
plants

Encourage children to bring two small plants each. Help them to compare their collections and notice the different plant forms. Show them a way to preserve plants by pressing them between newspaper sheets. See Fig. 8-1.

Fig. 8-1
It is easy to preserve plants by pressing them.

Ask children to collect the names of all the plants they eat.

1(b). PLANTS DIFFER IN SHAPE

Not all plants are alike. There is great variation in their shapes as well as sizes. There are trees like the banyan with widespread branches. Some other trees like the palm grow tall and straight. There is a third kind, like the pines which have needle-shaped leaves. To help the children understand that plants have various shapes, a simple activity like the following can be undertaken.

Field Observation | **What different shapes do plants have?**

Take the children on a field trip to an area where there are palm trees. (A botanical garden can be visited for this purpose, if there is one nearby.) Let children observe the difference in shape between a banyan and a palm tree. Encourage them to observe garden plants, like spinach or cabbage, as well as twining plants like the bean or the morning glory. All these plants have different shapes of their own.

Ask the children to draw plants of as many different shapes as possible. They should be plants familiar to children.

1(c). MOST FAMILIAR PLANTS HAVE LEAVES

Once children realize that there are plants of various shapes and sizes, they are ready to learn about the different parts of a plant. The flowering plants are the most complex type of plants. They have well-developed root, stem, and leaf systems, as well as flowers and fruits. There are also non-flowering plants like the mould and ferns that do not have these special parts. Leaves may be of various sizes and shapes. The leaves of different plants look quite different. Even two leaves from the same plant are not exactly alike. Activities such as the following will help children to understand that most familiar plants have leaves.

Investigation | **Are there many plants with leaves?**

Materials required
scissors
old newspaper sheets
assorted leaves

Encourage the children to pluck various kinds of leaves from different plants and study their difference. Help the boys and girls to draw the shapes of the different leaves they have collected.

Urge the children to bring samples of cactus or casuarina or mushrooms to class. Do these plants have leaves? The cactus has minute leaves, often at the base of the spines, and casuarina has leaves modified into scales, but mushrooms have no leaves. See Fig. 8-2*a and Fig.* 8-2*b.*

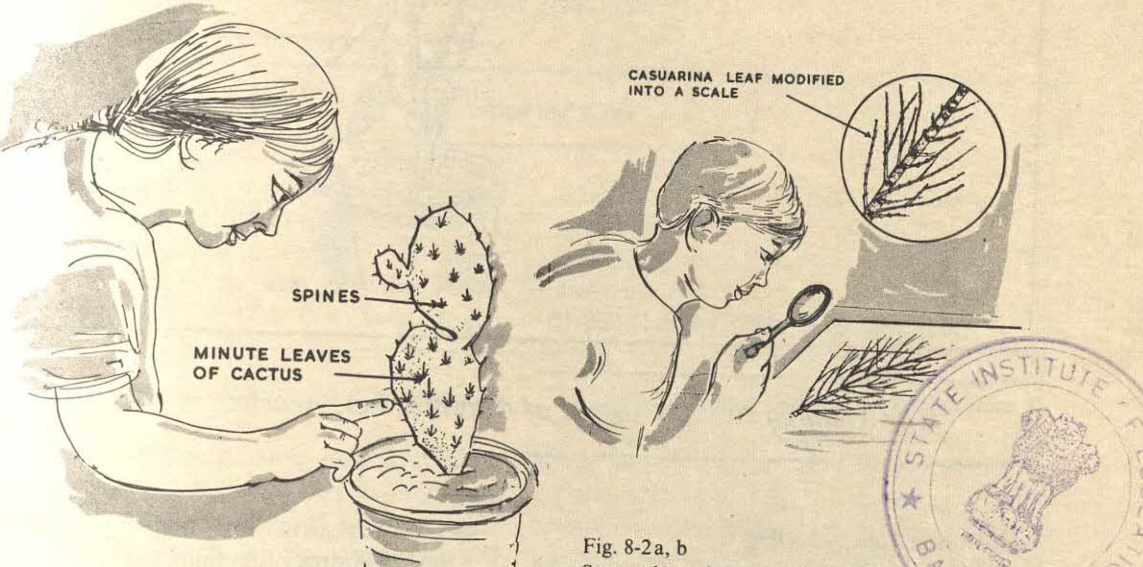
CASUARINA LEAF MODIFIED INTO A SCALE
SPINES
MINUTE LEAVES OF CACTUS

Fig. 8-2a, b
Some plants have greatly modified leaves.

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The task of the teacher here is to help the children to understand that leaves are important organs of a plant. They manufacture food.

1(d). SOME PLANTS HAVE THORNS

Children have already observed that plants have great variety. But not all plants possess similar organs. Some plants have smooth stems or leaves. Others like *bel* and *duranta* have thorns. The following activities may be undertaken to help students to recognize this.

Field Observation

How can we find thorns?

Encourage children to visit a garden and look around for thorny plants, like *bel*, plum, or acacia. Let them observe whether the thorns are growing from the surface of the trunk or axes of stems. Are there also leaves and branches as well as thorns? See Fig. 8-3.

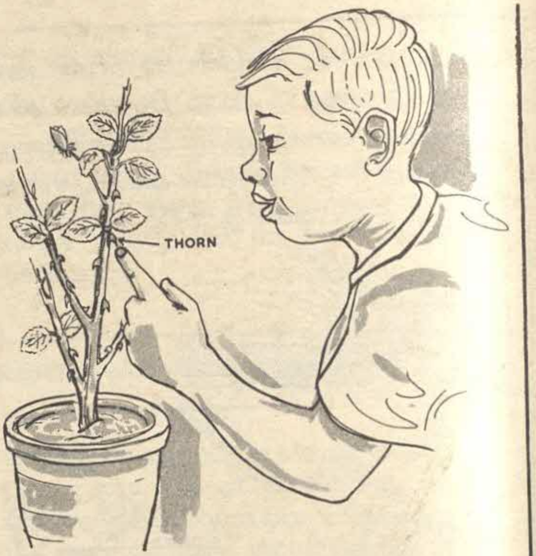


Fig. 8-3
Some plants have thorns.

Help children to draw thorns of duranta, bel, *Acacia.*

For Better Understanding

Thorns are organs of plants. They protect a plant from injuries. Some thorns are modified organs; for instance, the stem may be modified into a thorn. This can be seen in the thorns of such plants as cacti which produce rudimentary leaves that later fall off. The wild poppy leaves have on their margins as well as on their surface very many spines which protect the plants against cattle and goats. These are surface cells of the leaves which have been modified into spiny outgrowths.

1(e). SOME PLANTS GROW INTO TALL TREES

Small children often think that all seedlings will grow into plants of uniform size. The teacher can help them to understand that although all plants in the seedling stage are small, they will vary in size and length when they grow, and the rate of growth will also be different. Thus a mango plant and a gram plant in the seedling stage will be small, but one will grow into a huge tree and the other will only develop to a small plant. Help the children to understand the variety in the height of plants from the following activities.

Investigation | **What are seedlings of tall trees like?**

Arrange for children to see different types of seedlings like those of bean, corn, or mango grown in the garden. Help them to identify a few prominent types of seedlings they know, for instance, those of rice, mango, lemon. Ask them how these seedlings grow; do they grow into tall trees or small plants?

Encourage children to talk to the farmer who collects green coconuts from the trees. Are such trees tall ?

Class Work

Drawing tall trees

Encourage the children to draw some tall trees on the blackboard, for instance, a palm tree and a coconut tree. They can also draw a *devdar* (pine) tree, if they have seen it. Let them draw a man for comparison beside the tall trees they have just drawn, on the same scale as the trees. Help the children to understand that some plants can grow to be very tall.

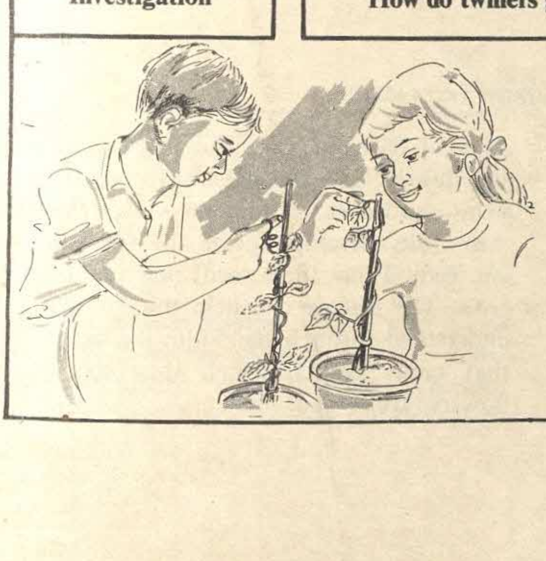
1(f). SOME PLANTS GROW AS CREEPERS OR TWINERS

Previous learnings have helped children to understand that plants vary in shape and size. Children have seen big trees and also small plants like mint. But there are still other kinds of plants which cannot stand erect because their stems are not so strong. The bean plants are familiar examples. So they creep on the ground. If there is a support, they climb by twining round it. The teacher can help the children to learn about more varieties of plants. The following activity will help to demonstrate a twining plant.

Investigation

How do twiners grow?

Materials required
pots
bean seeds



Help the children to sow bean seeds in pots. After some days the seeds will sprout and grow into seedlings. Let the children observe them for three to four weeks. The plants do not stand erect, but twine around supports as they grow. See Fig. 8-4.

Fig. 8-4
Some plants twine around a firm object for support.

Ask the children if they have seen money plants growing as creepers in houses.

1(g). SOME PLANTS SPREAD OUT WHILE OTHERS GROW STRAIGHT UP

Children have now gained experience with a large variety of plants. They have seen a palm tree; they have seen creepers. Simple observation should convince them that some plants have many branches whereas in others there is less branching and therefore the growth of the plant is mainly upwards. The following simple activity will help the children to understand more about the variety of shapes in plants.

Field Observation

Can we find trees which are erect and those which are not?

Have the children identify an Indian cork tree which is straight without much branching. Let them also see the bushy and branching type of shrubs and trees like jasmine or the *jamun* tree. Help them to understand that the profuse branching of a tree or a bushy plant makes it spread out.

Encourage each child to draw an areca palm tree.

2. MANY PLANTS GROW FROM SEEDS

Most familiar plants grow from seeds. Such plants as have fruits, nuts, berries or pods, start from seeds. The seed is the starting phase of a plant. With proper conditions, the seed sprouts to become a seedling.

2(a). MANY PLANTS BEAR FLOWERS, FRUITS, AND SEEDS

By now children know that a plant has different parts, such as roots, stems, leaves and flowers. The seedlings have only roots, stems and leaves. As they grow, flowers and then fruits develop. Inside the fruits there are seeds. From these seeds new plants can grow. The teacher can help the children to understand through the following activities that many plants, which they see, bear flowers, fruits and seeds.

Investigation

What are the parts of flowering plants?

Materials required
- collecting box
- old newspaper sheets
- seed bottles
- lables
- flowering plants

Help the children to collect several plants from the garden and encourage them to observe the different parts of these plants. Do they see flowers fruits and seeds? Help them to see that there are different types of fruits within which are contained seeds of various kinds. See Fig. 8-5.

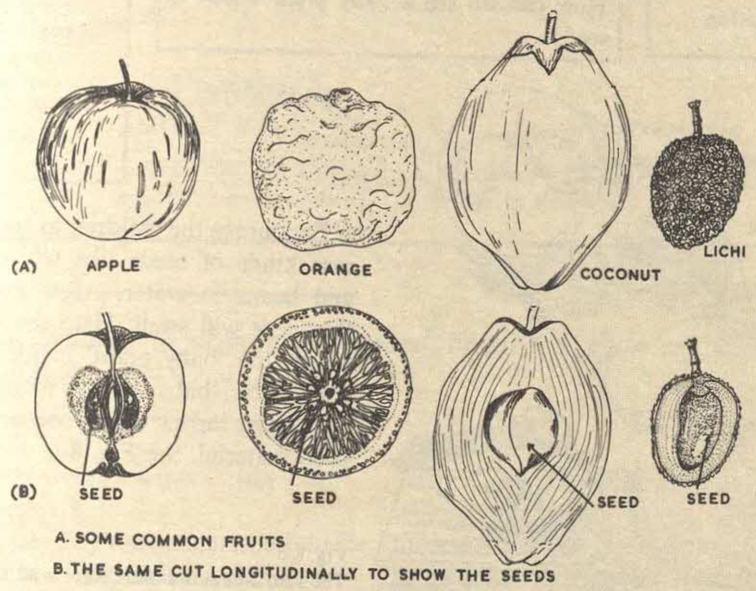


Fig. 8-5
Fruits contain seeds.

Let each child draw a flower or a fruit and then compare the drawings.

For Better Understanding

Besides flowering plants, there are non-flowering plants which do not produce seeds but reproduce by spores or other vegetative parts. Examples of plants which reproduce by spores are the ferns and the mosses. Children should be encouraged to see the moss and the fern plants or algae see the moss and the fern plants or algae growing in water, to confirm that such plants do not have seeds.

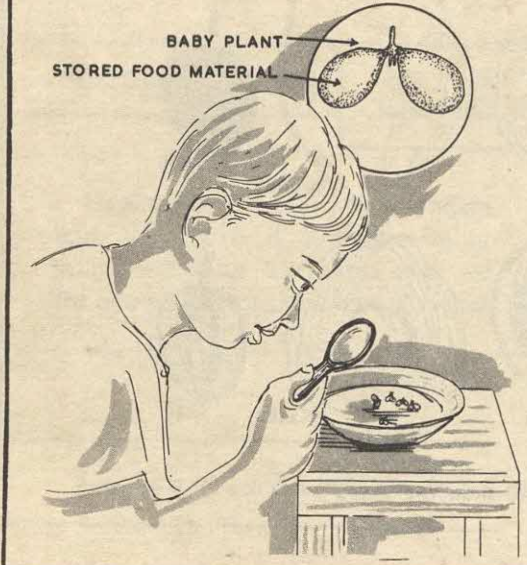
2(b). SEEDS CONTAIN SMALL PLANTS; SEEDS ALSO HAVE FOOD STORED IN THEM

The children now know that seeds contain a very small baby plant. When the seeds are sown, these baby plants come out of the shell of the seeds and grow. Seeds have stored food, which the baby plants utilize for their growth when they are very small. The teacher can help children to understand that seeds contain reserve food materials by examining soaked and germinating seeds.

Investigation

How can we see a baby plant inside a seed?

Materials required
wheat, bean seeds
water
small pots
penknife
old newspaper



Encourage the children to soak different kinds of seeds like wheat, gram and beans in water. After two days, the seeds will swell. Help the children to see the 'baby plant' inside a gram seed. The 'baby plant' includes the two fleshy halves which contain stored food material. See Fig. 8-6.

Fig. 8-6
The seed contains a baby plant with stored food material.

Investigation

Do seeds have food stored within them?

Materials required
sand and sawdust
seeds
water
small penknife
old newspaper sheets

Get the children to sow tamarind and wheat seeds in small boxes containing a mixture of sand and sawdust. They should be generously watered. After a few days, the seeds will germinate and small seedlings will come out. Help the children to remove the seedlings and examine them. They can see that the two halves in the tamarind seed or that part of the grain of wheat containing flour have grown thinner, as the stored materials are being rapidly used as food by the growing seedling. See Fig. 8-7.

Fig. 8-7
As a seed sprouts and grows into a seedling, it uses up its stored food material.

Allow children to draw a gram seed, opened to show the 'baby plant' within.

2(c). SEEDS GERMINATE WHEN THEY GET WARMTH AND MOISTURE

The children have by now understood that seeds grow into independent plants on germination. The children may be helped to realize that seeds are the dormant or resting stages of a plant and need certain external conditions like warmth and moisture without which they cannot grow into seedlings. The following activity may be performed for the children to understand that warmth and moisture are necessary for seeds to germinate.

Investigation

What do seeds need to germinate?

Materials required
boxes
seeds
sand and sawdust
icebox

Gram seeds may be sown in three boxes containing a dry mixture of sand and sawdust. The children should be allowed to keep one box inside a refrigerator, if available, or otherwise in an icebox. The box should be watered. The second box should be kept warm, but perfectly dry. The third box containing the seeds should be watered, and kept in a corner of the classroom. Let children see which of the seeds germinate and understand that for germination warmth and moisture are necessary. See Fig. 8-8.

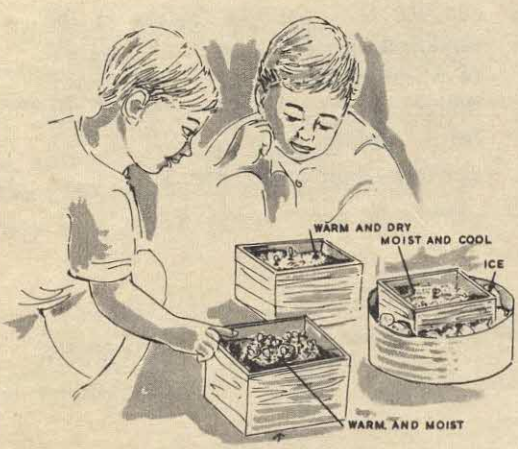


Fig. 8-8
Seeds need warmth and moisture to sprout

Help the children to wrap soaked cucurbita seeds in moist cloth. After a few days they will see seedlings sprouting.

3. MANY FOOD MATERIALS ARE OBTAINED FROM PLANTS

Begin this section by asking the pupils how plants are useful as sources of food. They can be asked what foods or plant-products they have eaten that day. The children should be able to list different types, as well as different parts of plants which they have consumed that day.

3(a). FOOD GRAINS (CEREALS AND PULSES) COME FROM SOME PLANTS

Once children realize that most of their daily food consists of parts of different plants, they will then be curious to learn which parts of the plants constitute the menu. One of their staple foods is rice or wheat or millet. They also take pulses like *moong* or *arahar*. Where do these grains of rice or wheat, or pulses like *moong* or *arahar* grow in a plant? Are they stems or leaves or fruits? The children can be led to understand that cereals and pulses are in reality the fruits or seeds of plants; activities like these below will help.

Field Observation

Children can see that pulses are fruits

Take the children on a visit to the village grocer's where different kinds of cereals like wheat, rice, *jowar*, *bajra*, maize and *ragi*, and pulses like gram, pea, lentil and *arahar* are displayed. Let them collect samples from each of the cereals or pulses. Help them now to visit an agricultural field, where wheat, rice, maize and pulses like pea, *arahar, moong* are growing. Visits can be arranged in different seasons of the year to see various standing crops. Let the children identify the grains with the corresponding parts of the plants which produce them. They will find that all of them are the fruits of the plants.

Investigation

How do grains differ in appearance?

Materials required
garden implements
needles, knives

Help the children to sow seeds of different cereals and pulses in a small kitchen garden. The plants should be nurtured to maturity and to their seed-bearing stage. Let the children see for themselves how grains of different cereals or pulses are produced by plants.

Let children bring rice and wheat grains and pulses like moong *and* arahar *to the class. Help them study and compare these seeds.*

3(b). SOME PLANTS (MANGO, BANANA, CITRUS PLANTS AND GUAVA) PROVIDE EDIBLE FRUITS

The children now understand that some crop plants produce grains. There are other plants which produce fruits. Grain and fruits are produced by plants for perpetuation of the species. From the seeds of the grains and fruits, new plants develop. Grains and fruits contain stored food materials for the young plant. Therefore, many of them are cultivated and consumed by man. Thus man obtains food from many plants and in turn helps in the propagation and preservation of these plants. Suitable activities can help the children to know that fruits are special parts of plants which serve as a source of food to man.

Field Observation

Which plants provide the fruits that we eat?

Encourage the children to name different fruit trees. Let them see, in season, unripe as well as ripe fruits on trees. Help them to understand that fruits grow singly or in clusters. Let them see how bananas and jack fruit grow. Let them also see guavas and plums and other fruits.

Let each child bring one ripe fruit to the class and name it. Prepare a list of the most common edible fruits. Are there some which are not edible?

3(c). SOME PLANTS PROVIDE EDIBLE VEGETABLES

The children now know that they eat different parts of plants, such as grains and fruits. The teacher can give more examples of parts of plants. The teacher can name plants whose leaves or stems or roots are eaten as vegetables. The following activities may be undertaken to help children realize that vegetables are special, edible parts of plants.

Field Observation

How can we learn about the vegetables that we eat?

Let children visit a vegetable market and identify different vegetables like carrot, spinach, beans, cabbage, cauliflower, potato, onion. Help them to understand that not the whole plant, but only special parts of different plants are used as food. For each vegetable named, let the children say whether they eat the fruit, or the stem, or the leaf, or the flower, or the root, or some other part.

Let each child name two vegetables. List them and say whether they are roots, stems, flowers or fruits.

UNIT 8

PLANT LIFE

CLASS II

Overview

The life of man would be completely different—or completely impossible—were it not for the world of plants. They supply many useful materials to man, like food and fuel, shelter and clothing, among other things. Plants even replenish the very oxygen in the air which man breathes. For these and other reasons, plant life is very important. And because plants are familiar to everyone and provide pleasure and satisfaction, they are also interesting. Some study of plant life therefore should belong to each class in a child's progress through the school.

In class I, three major concepts were considered.

1. There is great variety in plant life.
2. Many plants are similar in that they grow from seeds.
3. Many plants provide man with useful food materials.

Here in class II, the three major concepts to be studied are similar to those above.

1. There is great variety in the life span of plants.
2. Plants can be classified according to similarities.
3. Plants provide man with many kinds of useful materials.

The children should have a chance to acquire these broad and significant understandings without their being hidden by a mass of detailed facts. The notion of classification, in particular, should be taught as a general idea, not as a detailed system. Students should be helped to realize that scientists find it possible and useful to classify plants, and that there are many good patterns of classification. The system widely used by scientists is a useful one, but it is not the only one, and not necessarily the best one. At this class level, common names are preferred to scientific names. Children should learn only a few broad principles of classification, not the details of identification and naming. They should be helped to see the pattern that exists in the wide variety of plant life.

1. THERE IS GREAT VARIETY IN THE LIFE SPAN OF PLANTS

The children have now learnt a great deal about the variety of plant forms. They know that plants can be very small or very big. Some plants can be tall and straight; others may be spread out or may not stand erect but grow as creepers. Similarly, there are plants which live for a short time, e.g., the egg plant and the gourd. On the other hand, there are plants like the banyan or the *jamun* which live for many years. The teacher can help the children to understand that there are plants which live to various ages or lengths of time, by arranging the following activity.

Field Observation

Can children tell the ages of different plants?

Encourage each child to tell the ages of common crops and plants. Let them see crops of rice, wheat, and potatoes; vegetables like brinjals, *bhindis* standing in the field; and flowering plants, like marigold, *clitoria*, jasmine and cosmos at different times of the year. Let them also see the greenish pond-scum over a pool of water. Let them see the coconut, the banyan and the pipal trees. Help the children to understand that plants have different spans of life, after which they die.

1(a). TREES, SHRUBS AND MANY HERBS HAVE LONG LIFE SPANS

The teacher can conveniently introduce the concept that various plants live various lengths of time. Perhaps the children remember seeing a big tree, for instance, the mango tree or banyan tree, adjacent to their houses or to the school, ever since they were very small. The children will say that the tree has been there as long as they can remember. The teacher can help them understand that many trees or herbs or shrubs have long life spans by undertaking the following activity.

Discussion

Who can tell the age of the old pipal tree?

Let the children guess the age of the oldest pipal tree of the locality or the village. Let them also tell the age of the *duranta* hedge or the jasmine plant or the marigold plant they grow in the garden. Let them understand that different plants will have different ages. Thus the pipal tree will be very old; the *duranta* or the jasmine may be two to three years old; but the marigold will be less than one year old.

Let the children draw a mango tree, a marigold and a duranta *plant, and indicate their maximum age.*

1(b). GRAINS AND MOST VEGETABLES AND GARDEN FLOWER PLANTS LIVE ONLY ONE SEASON

While the children have just learnt that trees and other shrubs and many small plants can live long, the teacher can help them to understand that there are other varieties of plants which have short life spans. There are cereals and vegetables which live only few months. The following activities will illustrate this concept to the children.

Field Observation **Do rice plants live long?**

Arrange a visit for the children to a field where a crop like rice is grown in late summer, after the rains have started. The children will see plants growing, and in the seedling stage. Visit again after six months. The rice crop, which was there, is no longer there. Help the children to understand that rice plants, which have a very brief life span, have been harvested.

Class Project **Some vegetables and flowers live briefly**

Materials required
seedlings
garden implements

Encourage children to grow a few flowering plants like marigold, cosmos, dahlia or narcissus in early winter. Or they can grow vegetables like peas, potatoes, brinjals or tomatoes. After winter, all these plants will die. Help the children to understand that these vegetables or flowers have a brief life span; they die within a year.

Let the children ask a farmer when he sows rice, wheat and cabbage and when he harvests them. When does he grow cosmos and narcissus and when does he uproot them ?

For Better Understanding

The children may be encouraged to think that there is a very wide range in the life span of plants. A bacterium or the bread mould lives only a few hours. Algae usually live a few months. Then there are herbs which grow for a year or two and shrubs which grow several years. Finally there are trees which grow for many, many years.

Plants which live for one year are called **annuals.** Examples of annuals are the sunflower, mustard, rice, jute, and tomatoes.

There are plants which grow and live for two seasons. Examples of these are the cabbage, the radish, the beet, the carrot and the turnip. These are called **biennials.** Finally there are trees and other plants which live for a number of years. These are called **perennials.** Examples of perennials among herbs and shrubs are the canna and croton and ginger. All trees are perennials and live very long. Among longest-living trees are some cone-bearing trees, called the *Sequoia,* which grow in the western region of North America. Some sequoia trees are about 120 metres tall, and very wide at the base. Some are more than 4000 years old. Indian trees like the banyan or the coconut can live very long. The eucalyptus and the *bel* trees also have a long life span.

Children may like to know how the age of a tree is determined. One of the easiest methods is to count the number of annual rings in the trunk. For each year, a tree shows one circular ring in its woody part inside the stem. Thus, from a count of the number of rings, it is possible to determine the age of the tree.

2. PLANTS CAN BE CLASSIFIED ACCORDING TO SIMILARITIES

The children have learnt that plants are of various sizes and shapes and occur in a great variety of forms. They have seen that some plants grow high whereas others grow as creepers. Among trees, some plants spread out whereas others grow straight up. The teacher can tell the children that plants with similar type of features can be grouped together. Children should understand that the grouping of plants with similarities is a system evolved by man for his convenience. For instance, plants with a particular size or shape of leaf may be grouped together. Similarly a particular type of fruit or seed arrangement may be taken as the identifying feature of a group of plants; or, other criteria can be considered.

2(a). PLANTS MAY BE CALLED TREES, SHRUBS, OR HERBS ACCORDING TO THEIR SIZE

Children now know that plants can be conveniently divided into groups according to size. Some plants are tall, some are of medium size and others are small. Those land plants which are very big are called trees. Those which are smaller and bushy but have strong stems nevertheless, are called shrubs. Those which are still smaller and have weak, slender stems are called herbs. The teacher can undertake simple activities such as those given below to demonstrate the three types of plants to the children.

Field Observation

How can childern tell the difference among trees, shrubs and herbs?

Encourage the children when they are in the playground or in the garden to observe different plants. They will see tall plants (trees) like mango, *jamun,* and coconut. In the hedge or corners of the garden or the playground, the children will often see bushy, stiff-stemmed plants (shrubs) like *nerium*, jasmine, and *duranta* which are shrubs. Similarly small but weak-stemmed plants (herbs) like *ipomoea*, balsam or most of the vegetables such as cabbage and spinach can also be seen.

Discussion

How can children classify plants?

Materials required
old journals
scissors
three cardboard pieces

Allow the children to bring old newspapers or journals showing pictures of different plants. Let each child cut a few pictures of plants from the pages of such journals. All the pictures can be grouped into trees, shrubs and herbs and then pasted on three pieces of cardboard. Let the children see various types of trees like the banyan or pipal and shrubs like cotton and herbs like peas and potatoes in the pictures. Let them hang the three pieces of cardboard on the wall of the classroom.

Let the children draw a banyan tree, a cotton plant, and a cabbage. Help them to compare the sizes of these plants.

2(b). HERBS MAY BE CALLED CREEPERS OR TWINERS IF THEIR STEMS ARE NOT ERECT

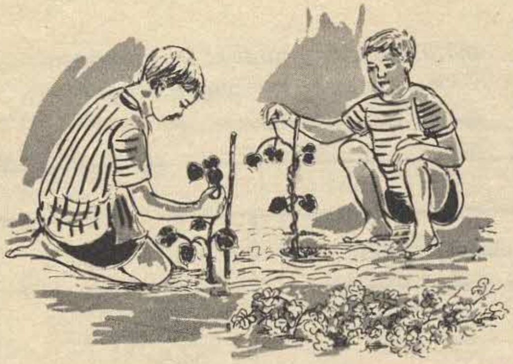
Children have now learnt that common plants can be classified into trees, shrubs, and herbs on the basis of the size of the plants. They have seen that small, weak-stemmed plants are called herbs. Thus plants like peas or rice or wheat or potatoes or flowers like lilies and *arum* are all herbs. Most herbs are small plants and some of them can grow a little in length, but then they cannot stand erect, because they have weak stems. So these plants either creep on the surface, as *ipomoea*, or twine round some support, as beans. The following activities will help the children to understand how some herbaceous, weak-stemmed plants grow as creepers or twiners.

Investigation

Can we grow twiners and creepers?

Materials required
seedlings
supports
cards

Encourage the children to sow seeds of *basella*, *ipomoea*, gourds, and beans in the school garden. The seedlings will gradually grow in length, but they have weak stems and hence will not be able to stand erect. Help the children



to fix small sticks or supports for the plants. In a few weeks, plants like the beans and *basella* will grow up, twining around the supports. *Ipomoea* or gourd will creep on the surface of the earth. See Fig. 8-9.

Fig. 8-9
Many common plants have weak stems and cannot support themselves.

Field Observation

Can children identify weak-stemmed creepers and twiners and climbers?

Arrange a visit for the children to a garden or a field nearby. Have them examine various types of weak-stemmed plants. Some of them like *parmal* or *vitis* or *evolvulus* creep on the surface of the soil. Others grow twining on trees and other objects which provide support, as in *basella*. There are a few which hang from supports by small hook-like appendages as in *artabotrys* or by means of roots which they develop at intervals along the length of the stem. See Fig. 8-10.

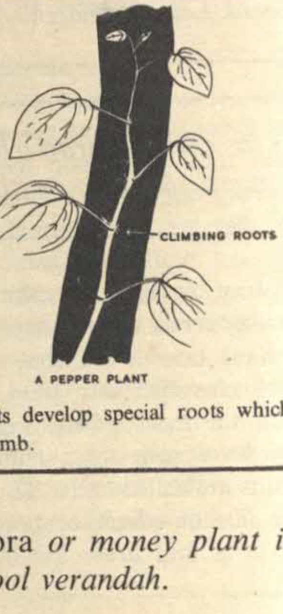


Fig. 8-10
Some plants develop special roots which help them to climb.

Allow children put small twigs of canscora *or money plant in pots and hang them from a sling in the school verandah.*

Scientists at Work

The idea of classification is a common one. It is particularly important for scientists.

The general idea of classification is familiar to everyone of all ages and all ways of living. When we have many things in a collection, it is very natural to arrange them into natural groups. We do this with foods—or with playthings, or with clothes, for example. Thus, clothes may be arranged with summer clothes on one shelf and winter clothes on another. Or the shirts may be kept in one place, the sarees in another, and the frocks still elsewhere. In these ways, clothes may be classified on the basis of their use, or their design. No matter what the system of classification may be, it serves some purpose. In the case of clothes, there are many schemes of classification. The choice of which classification to use depends on its purpose and on the person who does the classifying. It is also important to realize that the clothes do not 'simply fall naturally into groups'. Rather, the system of classification is selected or invented by the person who does the classifying.

This is much the way it has been with systems of classifying plants. Man has always interested himself in plants of all kinds. Primitive man knew that plants provide him with food, shelter and medicines. There are religious poems composed in praise of trees in ancient Hindu, Arabic, Hebrew and Greek literature. In describing the plants, very often they have been classified or grouped according to certain common traits.

It is remarkable how the human mind has functioned in widely separated lands, as in India and Greece, in the same way in its approach to classification. The Indian scientist-philosophers had thus described the plant kingdom as falling into three (or sometimes four) categories such as *vriksha* (tree), *gulma* (bush) and *lata* (creeper). Similarly the Greek philosophers divided the plants into creeping plants, herbs, upright trees and the like. They attempted also a system of classification based on the shape of the stem or leaves, etc.

Finally, a Swedish botanist named Linnaeus evolved an ingenious system of classification by taking into consideration the number and shape of parts of flowers. This system of classification of plants has been found so useful that it is the basis of plant study throughout the world today.

Plants are not classified by 'nature'. They are classified by *man*. Through a good system of classification, people can better identify, study, and use plants. Thus we see that classification makes the study of plants not harder, *but easier*!

For Better Understanding

Climbers are plants with stems which are weak, thin, and long and have little branching. These plants grow in length but cannot support themselves because the stems are weak. Creepers climb by various means, by rootlets formed at intervals along the length of the plant as in the betel vine, or by clusters of roots forming a disc as in the begonia, Indian ivy (*ficus pumila*), or by other special organs like hooks as in *artabotrys* and tendrils as in peas.

The children have learnt already that plants vary in size and can be divided into trees, shrubs, and herbs. All plants can be classified into trees, shrubs and herbs on the basis of size. Similarly other features can be used as a basis of classification. For example, the presence or absence of seeds is a feature that can help scientists to divide all the plants into two large groups. These are the seed-bearing plants (like trees and most garden plants) and non-seed-bearing plants (like the algae, the mushrooms and the ferns). Further sub-division of one of such big groups can be attempted. For example, consider the presence of one seed-leaf, like corn, or two seed-leaves, like the bean. Further divisions can be made by taking into account more and more features.

3. PLANTS PROVIDE MAN WITH MANY KINDS OF USEFUL MATERIALS

There are many varieties of plants which grow on earth. Not all of them are of direct use to man. There are many harmful and unwanted plants. Man chooses only those plants which are useful to him. These he grows for food or for clothing or shelter or medicine.

3(a). A FEW PLANTS ARE TOTALLY EDIBLE

Small children often think that all parts of all plants can be used and are edible. They should be helped to realize that only special parts of plants are eaten by man; the rest of them are of little use to him as food. In only a few cases can all the parts of a plant be taken as food. The following activity will help students to understand that as a rule only selected parts of plants are eaten.

Field Observation | **Are there plants of which all parts are eaten?**

Encourage the children to visit the vegetable garden in a farmer's backyard. Help them to see different vegetables and name those parts which man consumes as food. Ask them if they can recognize a spinach or an onion or a cabbage plant. Point out that most or all the parts of these plants are edible.

Let the children prepare a list of plants which are entirely eaten (for example, beets).

3(b). THE LEAVES OF SOME PLANTS ARE USED AS FOOD

Children have learned that in the case of a few plants, all parts are eaten. But there are other plants, only special parts of which are consumed. Leaves are an important source of food. Leaves of *puin* or *natia* are used as food. The following activity will help children to realize that many greens are cooked and eaten and that leaves can be one of the important sources of food.

Investigation

Do we eat leaves?

Materials required
different leafy vegetables

Encourage children to collect whole leafy plants like *pudina* and *mentha* from a vegetable garden. Leaves of these plants are eaten. Help the children to remember whether the leaves are eaten raw or cooked.

Have children ask their mothers what other leafy vegetables are eaten and how they are cooked?

3(c). THE LEAVES OF SOME PLANTS ARE USED TO PREPARE DRINKS

The children have learned that leaves of some plants are used as food. The teacher can help them to understand that leaves are used also for other purposes. For example, dried leaves of tea-plants are used to make the beverage. An activity like the one mentioned below will help the children to recognize this.

Class Work

How are tea-leaves prepared?

Materials required
pictures of tea growing
hot water
pan
tea

From the picture of a tea-garden, help children to understand how leaves are collected, then dried. Have children notice the women plucking leaves, collecting them in baskets and drying them in the factory shed. When the dried and cured leaves are dropped in warm water, one gets tea.

Class Project

Let's prepare a drink of tulsi

Materials required
pan
tulsi leaves
hot water
strainer
cups
newspaper sheets

In the small garden of the school, the children can find *tulsi* and *mentha* (peppermint) plants. Encourage them to pluck a few leaves and dry them between folds of old newspapers. The dried leaves can be further dried in the sun. On pouring boiling water on the dried leaves, the children will get a beverage of *tulsi* leaves.

Have children observe their mothers making a cup of tea at home.

3(d). DEAD PARTS OF PLANTS ARE USED AS MANURE

The children have learned that leaves of some plants are eaten. Dried leaves of some other plants are used to prepare drinks. The teacher can show the children further that leaves of some trees and smaller plants are used for other purposes, even when they are not fresh. Thus dead and fallen leaves are collected, particularly in winter, and are kept in heaps. They are used later as manure. The above can be demonstrated through the following activity.

Field Observation

How is manure prepared?

Encourage the children to visit a farmyard where organic manure is being prepared. Help them to see how farmers pile dead leaves, dried stalks of legume plants and corn and cover them up with cow-dung and soil. Let children realize that the dried leaves slowly change their properties when they are so covered and are converted into compost, which is a kind of manure.

Have children ask the gardner how he prepares leaf-manure and how he uses it.

For Better Understanding

The leaves and other parts of plants are composed of organic substances like carbohydrates, fats and proteins and small quantities of inorganic salts. Dead plant materials, like leaves or stems, fall to the ground. The organic substances are acted upon very slowly by bacteria, which convert them into simpler chemical substances. When cow-dung and soil are used to cover the dead leaves for production of compost, this process of decomposition by bacteria is hastened.

3(e). THE ROOTS OF SOME PLANTS ARE USED AS FOOD

Not only leaves but also stems and roots and other parts of plants serve as sources of food. Examples of underground stems serving as a source of food are the tuberous plants. The most common of these is the potato. Another example is the yam. The teacher can encourage the children to understand that tubers are important sources of food supply through the following activities.

Field Observation

How are potatoes grown?

Encourage the children to visit a vegetable garden where potatoes are growing. Help them to see how furrows are made in the field and how potatoes are grown on the crests of the furrow. Let them remove the top-soil and see how small potatoes have grown on the underground stems.

Let children collect tubers of arum and yams and tapioca from the garden. See how many edible roots can be collected.

For Better Understanding

Small children often think that any part of a plant which grows underground is the root. They may ask if tubers are roots. The teacher can help the children to understand that the stems bear leaves, whereas roots do not. The potato, which is the underground part of the plant, is called a tuber and is really a shortened and swollen stem. The eye of a potato bears a scale leaf and a small bud, from which another plant of potato can grow.

3(f). FRUITS AND SEEDS OF MANY PLANTS ARE USED AS FOOD

Like leaves and roots, other parts of plants are also used as food. Fruits and seeds constitute sources of important food materials to man. The teacher can help the children to understand this by undertaking the following activities.

Investigation

Where do fruits grow?

Materials required
fruits

Encourage the children to bring one fruit each from their house or garden. Let them bring mangoes, bananas, guavas. The names of all the fruits collected may be written on the blackboard.

Investigation

How can children study the various grains and seeds they eat?

Materials required
grains
seeds of various types

Encourage the children to collect different kinds of grains and seeds of cultivated plants which are eaten by man. Help them to arrange the grains and the seeds from each plant separately and name them. Discuss how the seeds are eaten—peeled or unpeeled, raw or cooked.

Field Observation | **How do grains grow on plants?**

Help the children to visit the village grain store and collect samples of different grains like wheat, rice or maize. Also visit a field where there are standing grain crops. Let children bring a few sheaves of rice and wheat, and maize grains to the classroom. Compare the grains collected with those on the sheaves. Help students to realize that only the grains from these plants, and not the whole plants are eaten. Help them to observe the threshing of the sheaves to separate the grains.

Encourage the children to ask their mothers how they cook rice or wheat and how these grains are obtained and from which parts of this plant.

Let the children cut a guava or a cucumber and see the seeds inside the fruit they eat.

3(g). STEMS AND FLOWERS OF SOME PLANTS ARE USED AS FOOD

The children have seen that the different parts of plants are used as food. They can be helped to understand this better by giving more and more examples. Not only fruits and seeds or leaves, but other parts of plants, such as stems and flowers, are also eaten. Children can be helped to understand that stems and flowers are also used as food through the following activities.

Field Observation | **Which parts of sugar-cane contain juice ?**

Allow the children to visit a sugarcane crop and get a few canes with the permission of the farmer. Help them to understand that the stalks, that is, the stems of the canes are used as food and are crushed to extract juice for producing sugar. Let them taste a little of the juice which is sweet. The leaves and roots cannot be used as food, but are used for other purposes.

Investigation

Do we ever eat flowers?

Materials required
collected flowers

Plan with the children to collect flowers from different trees and plants. From the collected flowers, help children to find that most of the flowers cannot be eaten. But there are flowers like that of the banana, tamarind, *moringa* or *sesbania* which can be eaten as food.

Encourage children to draw a sesbania flower and a banana flower.

3(h). SOME PLANTS HAVE SEEDS FROM WHICH OIL IS EXTRACTED

Vegetables, fruits, seeds, and roots are not always used in the exact form in which they are obtained from plants. Man needs oil for frying and cooking and for other purposes. Oil is obtained from the seeds of certain plants. The teacher can encourage the children to perform the following activity to show that some seeds contain oil.

Field Observation

What happens in an oil mill?

Take the children on a visit to the local oil mill, bullock or power driven, where oil is extracted from mustard, *til* or ground-nut seeds. Allow the children to ask the miller to show how seeds are conveyed inside the mill and how oil is extracted when the mill is turned. See the oil-cake, which is the crushed remnant of the seeds after the oil has been extracted.

Investigation

How do we get oil from seeds?

Materials required
different seeds, like ground-nut, *til*
sheets of paper

Allow the children to bring to the class seeds of mustard, ground-nut, *til* rape or castor which yield oil. Let the children crush seeds of grount-nut or *til* between sheets of paper. See the stains of oil on paper. Let the children learn about the seeds and the oil they produce. See Fig. 8-11.

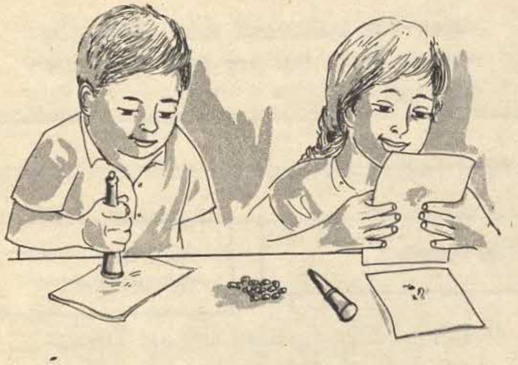


Fig. 8-11
Many seeds provide oil when they are crushed.

Investigation

Children extract oil

Materials required
mortar and pestle
ground-nut and
mustard seeds

Encourage children to crush some seeds of ground-nut or mustard in a stone mortar and pestle. The seeds will soon form into a sticky paste. Let them touch the paste and taste a little of it. Note that it is oily.

Let the children visit the grocer's shop and see ground-nut, til *and mustard oil.*

3(i). SOME PLANTS ARE SOURCES OF MEDICINES, PERFUMES, GUMS AND RUBBER

It is not for food alone that man depends on plants. The teacher can help the children to understand how different parts of plants are used by man for his other needs, such as shelter against natural hazards, or for medicines. Many drugs are obtained from plants. Similarly perfumes are made from fragrant flowers like jasmine or rose. There are plants like acacia which secrete useful gums from their bark. The sap from the rubber tree has great industrial use. The following activities may be arranged to help the children to understand the various uses of plants.

Field Observation

Children can see some medicine plants

Materials required
collection box
newspaper sheets

Let the children visit a garden accompanied by the village physician or an experienced gardener or a chemist. Collect wild plants of medicinal properties, such as *datura, asclepia, malva, bryonia*. All of these have special medicinal properties against different diseases. Observe that not all parts of the plants, but special parts like the leaves or the roots or the dried stalks are used in preparing medicines.

Investigation

Some flowers are fragrant and yield perfumes

Materials required
flowers

Allow the children to collect flowers and bring them to the class. Some of the flowers will be fragrant. Help the children to realize that perfumes are extracted from such fragrant flowers as rose, jasmine, and *bel*.

Investigation

How do acacia trees produce gum?

Materials required
acacia twigs
gum
bel

Encourage the children to find an acacia tree and bring some twigs to the classroom. These commonly show gum collected on the crevices of the bark. The gum is scraped and sold for commercial purposes. Also allow children to break open an unripe *bel* fruit and observe how gum is contained within. The gum is used as medicine.

Class Work

What common things are made of rubber?

Materials required
different rubber articles
picture books

Encourage children to name a few articles made of rubber. They will suggest shoes, erasers, tyres and balloons. All these articles are made of rubber. Let the children see a rubber tree from a picture book and learn how rubber is obtained from the rubber plant. Let them see different pictures on the processing of rubber goods from raw rubber. See Fig. 8-12.

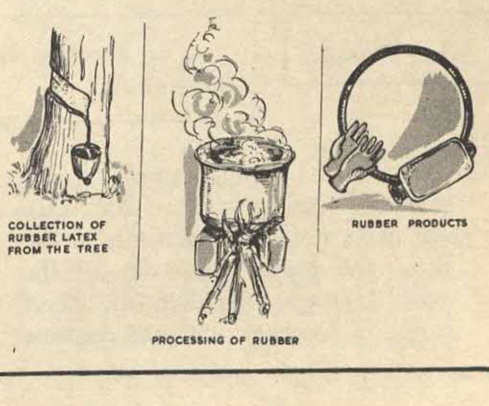

COLLECTION OF RUBBER LATEX FROM THE TREE
PROCESSING OF RUBBER
RUBBER PRODUCTS

Fig. 8-12
Rubber is an important product from plants.

Let the children press twigs and flowers of neem, adhatoda, *or jasmine between newspapers, dry them and then prepare sheets with the dried twigs fixed on them.*

For Better Understanding

Rubber plants generally grow in tropical countries like South India and Malaya and Brazil. When the trees are two to three years old, their bark is cut spirally. The sap than drips down from these cuts. The sap is collected in cans placed at the end of the spiral cuts. This is later collected and made into blocks of crude rubber. The blocks are then transferred to factories for preparing different commercial articles.

3(j). FLOWERS AND LEAVES OF SOME PLANTS ARE USED FOR DECORATION

Besides meeting the physical needs of man, plants also provide great pleasure. For instance, rooms and houses are decorated with flowers. Leaves of plants like mango or banana are used for decoration, for preparation of arches at marriage ceremonies or religious occasions, etc. The teacher can help the children to understand the various ornamental uses of flowers and leaves with the following activities.

Class Project

Let's make a bouquet

Materials required
- flowers
- leaves
- scissors
- string
- vases

Challenge children to collect various flowers and leaves as well as twigs. Assist each child to make a bouquet or a garland and decorate his desk.

Class Project

Can we decorate our classroom with flowers?

Materials required
- flowers
- thread
- scissors
- vases

Encourage the children to form into groups of four or five, each of which will make floral arrangements in the class, one group every day of the week. A group of children can collect various flowers each day and decorate their classroom in various ways. By the end of the week, see which group did the best job of floral decoration.

Let the children collect and name flowers that are used for preparing garlands. See who can make the finest garland.

3(k). SOME THORNY PLANTS ARE USED AS HEDGES

By now the teacher has been able to give the children various examples of the many uses of plants. The children know the use of plants as food, as medicines or for decoration. Plants are used as hedges also, to protect other plants against cattle. The teacher can show such uses of plants by undertaking the following activities.

Field Observation | **Of what use are hedges?**

Allow the children to visit a flower or a vegetable garden. The garden may be surrounded by hedges. Help the children to touch and to feel the hedges, where thorny plants like *duranta* or *lawsonia* have been grown. Help children to understand that without thorns it would have been difficult to protect the plants inside against stray cattle and thoughtless children.

Let children bring a twig of duranta *and draw the leaves and the thorns.*

3(l). SOME TREES PROVIDE WOOD FOR BUILDING AND FOR FUEL

The teacher has now given ample examples of the use of different parts of plants to his pupils. They have included the use of plants as vegetables, food, medicines and for beautifying houses. The wood from trees is used for beams and furniture. The teacher can conduct an activity like the following to help children to understand how woods are put to various uses by man.

Class Work | **How is wood used in the school building?**

Encourage children to look around the room and say how wood has been used in the building or furniture and see that the beams of the room, the doors and the windows, the tables and the blackboard are made of wood.

Field Observation **How does the village carpenter work?**

Encourage children to observe the work of the local carpenter. What materials does he use? What tools does he need? How does his work depend on living things?

Field Observation **How is firewood prepared?**

Encourage children to visit the local coal and firewood shop. See how firewood is hacked out of bigger logs which cannot be used either as beams or for furniture.

Let children ask the carpenter what kind of wood has been used for the furniture, for the beams, for the windows and for the blackboard.

3(m). SOME PLANTS YIELD USEFUL FIBRES

Plants have many uses. Besides providing food and materials for building they also provide fibres. Most fibres are of plant origin. The teacher can encourage children to think of examples of the uses of plant fibres. Some children may say that clothes are made out of plant fibres. The following activities can be undertaken to help children appreciate the many uses of plant fibres by man.

Investigation **Can we see the different uses of fibres?**

Challenge the children to collect different fibres of use to man. Let them bring clothes, ropes, some mattresses, cords, etc., made from plant fibres or show how these are made

Field Observation **Which are some of the fibrous plants?**

Encourage children to see a cotton, jute or sunhemp plant during a visit to the field. See how cotton can be spun into thread and how jute and sunhemp are retted to get fibres. See Fig. 8-13.

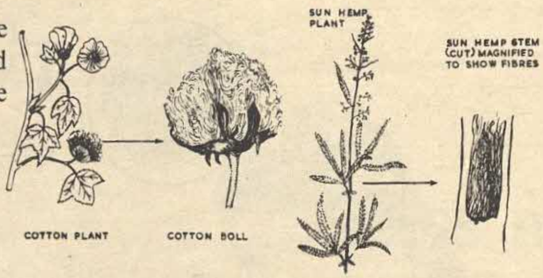

SUN HEMP PLANT
SUN HEMP STEM (CUT) MAGNIFIED TO SHOW FIBRES
COTTON PLANT
COTTON BOLL

Fig. 8-13
Some plants yield useful fibres.

Investigation

From what plants do fruits and seeds and also fibres come?

Help the children to know that fibres are obtained from various parts of different plants, including the outer covers of seeds or fruits. Collect the help the children see where the fibres come from.
seeds of *simul* and coconut fruits and

Discussion

How is paper made from fibres?

Materials required
pictures of a paper mill

Let the children see a picture of a paper mill and its various departments, where raw materials are fed, then crushed and made into a paste, called pulp, and then pressed into sheets of paper. See how barks, old clothes and bamboo go into the production of pulp. Help the children to understand that paper is made from vegetable fibres.

Investigation

Can we see a fibre through magnifying glass?

Materials required
magnifying glass
blotting-paper
water

Let the children see the grains of thin and shredded blotting-paper under a magnifying glass after the fibres have been swollen with water. The children will see small sickle-shaped or spindle-shaped fibres floating in the solution as in Fig. 8-14. Let the children understand that the small fibres, in a compact form, have gone into the making of the blotting-paper.

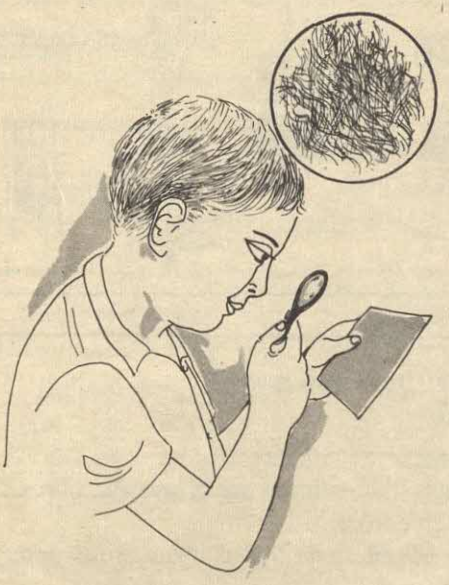


Fig. 8-14

Paper contains fibres visible under a magnifying glass.

Help children to examine a sisal rope, a coconut rope and a jute cord. Let them feel the difference in strength and texture.

For Better Understanding

Paper is manufactured by special processes. It can be manufactured on a cottage industry basis but mostly it is produced in large factories. The basic ingredients for the manufacture of paper are special kinds of wood or bamboo or particular types of grasses and also old discarded clothes. The bark of wood and other substances are washed, crushed and then treated with strong chemicals. After thorough washing, the chemicals are removed and the softened wood-pulp remains. The pulp is then strained and the fine sediment is spread in thin sheets and dried. Finally the paper is rolled or is cut into sheets of useful sizes.

UNIT 8

PLANT LIFE

CLASS III

Overview

Man's life is very intimately related to plant life. Without plants, human life as it is now known would not only be unpleasant, it would be impossible. Because plants provide man with pleasure and the necessities of life, he finds them interesting and important. For this reason the study of plants is important to man. Through better understanding of plant life he can grow plants better, use them more effectively, and appreciate them more thoroughly.

In earlier class levels, students have learned about the variety and the pattern of plant life and about some of the uses man makes of plants. At this level, the study of plant life becomes a little more detailed.

Here in class III, students will begin to look at a plant not simply as a whole organism. Rather, they are introduced to a few of the major parts of a common plant and to the functions which each part performs. In particular, they consider the food-making activity of green plants. They again study seeds, their structure and function—this time in more detail than in class I. Finally, these students learn about soil and its relation to plant life.

Children at this class level should be permitted to learn about the structure and special parts of plants in a natural and comfortable way. Little, if any, emphasis should be placed on memorization of the names of plant parts. Where possible, common terms are preferred to scientific terms. The objective here is not to have children know the details of plant anatomy. Rather, they should get the idea that various parts of a plant are specialized in structure and function. The details are merely illustrations of this large and important understanding.

1. A PLANT HAS DIFFERENT PARTS

The typical parts of a plant can be seen in a flowering plant, for example, in a common annual plant, like a sunflower or mustard. In these plants the various organs have particular functions to perform, but the life process goes smoothly only when all the organs work together harmoniously. Thus there is a clear division of labour among different plant parts. The roots, stems, leaves and flowers are the organs which are indispensable for plant life. The following activities may be undertaken to help the children to understand better the different parts of common plants.

Investigation

Do plants have different parts?

Materials required
balsam, mustard, etc.

Encourage each pupil to bring one entire small plant. Some children may just bring an uprooted plant. Others may be careful and bring whole plants with their roots, leaves and other parts complete. Let children say how many different parts they observe. Roots, stems and leaves will obviously be there. Can they find also flowers and fruits? Is there any other particular structure present in a plant which is absent in others, such as thorns, or hair on leaves?

Investigation

How can we study the various parts of plants?

Materials required
various seeds
glass tumblers
small pots

Encourage the children to sow seeds of mustard, pea, wheat, rice, cosmos, etc. in small pots with a mixture of sand and sawdust. In a few days they will see seedlings coming up. Let them uproot a few plants carefully after a few weeks, and observe their parts. How many parts can each child name? Do they see roots, stems and leaves? Do they also see flowers and fruits?

Encourage the children to examine and identify the different plant parts of common vegetables.

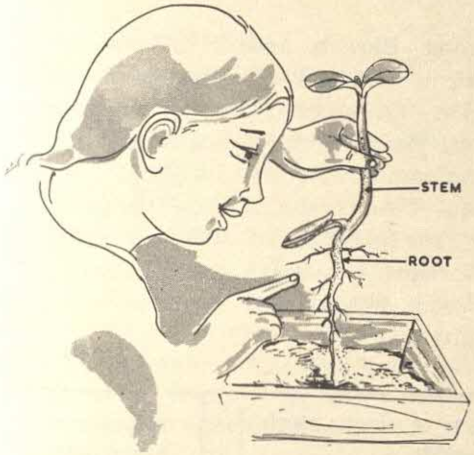
1(a). A ROOT IS THE PART OF A PLANT WHICH IS UNDER THE SOIL

One of the important organs of the plant is the root. While learning the different parts of plants children can see how roots grow inside the soil. They will notice that roots grow under the soil and away from the light, and that they are not green. The following activities will further illustrate to the children that roots grow under the soil.

Investigation

Where do roots grow?

Materials required
various seeds
small pots
sand
sawdust



Encourage the children to sow seeds of bean, gram and cucumber, wheat and maize, in a moist mixture of sand and sawdust, as in the previous activity. After a few days, seedlings will germinate. Help the children to see from uprooted seedlings that small roots from the seeds have grown inside the mixture of sand and sawdust, while small shoots are coming upwards and are green. See Fig. 8-15.

Fig. 8-15
The root grows in the soil, and the stem grows upwards.

Investigation

Can we distinguish different types of roots?

Materials required
cut roots of
different plants
old newspaper

From the uprooted seedlings in the previous activity, help children to cut the roots from below the stem, wash them and place them side by side on a piece of paper on the table. Can they see any difference in the types of roots? Some roots, as in bean and cucumber, will be long and tapering with side roots. In others, like the grass and the wheat, there will be no big main roots with small side roots; rather, all the roots will be in a tuft. Help children to understand the difference in the structure of the roots of bean and grass, cucumber and wheat. See Fig. 8-16.

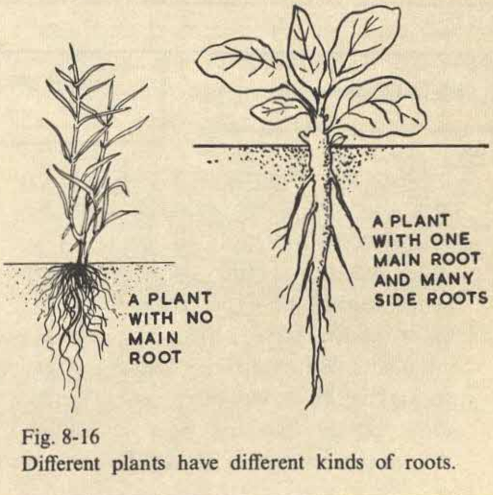

A PLANT WITH NO MAIN ROOT
A PLANT WITH ONE MAIN ROOT AND MANY SIDE ROOTS

Fig. 8-16
Different plants have different kinds of roots.

Let the children ask the gardener about roots of various plants. Do they grow underground?

1(b). STEMS, LEAVES, FLOWERS AND FRUITS ARE PARTS OF A PLANT THAT ARE ABOVE THE GROUND

The children have learnt that roots remain underground. They know there are other organs of plants, like stems, leaves and flowers. The stem helps the plant to stand erect in most cases; some plants have weak stems, so they creep. The stem bears leaves so that the plant is able to manufacture food. Flowers and fruits grow from the stem. Seeds are contained inside the fruit. They are necessary for the propagation of the plants. Stem, leaves, flowers and fruits are important parts of a plant. These parts, unlike roots, remain above the ground.

The following activities may be conducted to help the children to understand that stems, leaves, flowers and fruits remain above the ground.

Investigation

Can we see those parts of plants which grow above the ground?

Materials required
different seeds
seedlings
pots
sand
sawdust

Children have already grown seedlings in small pots in sand and sawdust mixture. Let them uproot seedlings of bean, cucumber, wheat and maize and see that the green parts of the plants remain above the soil. Help them to name the different parts they find in each plant that remain above the ground.

Field Observation

Which parts of a plant grow above the soil?

Allow the children to visit a field of crop and also a garden. Help them to understand that not all parts of a plant mature at the same time and hence cannot be expected to be seen. Most plants have stems and leaves; but a few will also show flowers, fruits and seeds, all at the same time. Again, some plants like the beet or radish may not show a stem above the ground at all. Other crops like sugar-cane do not appear to produce a fruit. So while all plants show different green parts above the ground, not all of them may possess distinct stems or leaves or flowers or fruits. Let the children collect different plant parts and say if these are roots, stems or leaves or flowers or fruits.

Let children draw pictures of plants like mustard, bean and maize and label different parts.

For Better Understanding

A germinating seed shows a small axis with a tiny leaf or leaves and a small root. The tiny leaves are called *plumules* and the bud is between them. The tiny root is called the *radicle*. The root descends into the earth. The main root gives branch roots called the secondary and the tertiary roots. But in plants with one seed leaf, like wheat or grass, the main root does not grow further. It dies away and a cluster of roots develops from the base of the seedling. These are called *fibrous roots*.

The functions of the root are to absorb water and minerals from the soil and to fix the plant firmly in the ground. Small minute hairs (root hairs) grow near the tips of roots. These help in the absorption of water and minerals in solution. Besides the above functions of absorption of nutrients and fixation, some roots may also store food materials.

The plant body is often defined as consisting of two parts, the root and the shoot. The term 'shoot' includes the stem with the branches, the leaves, the flowers and the fruits. The growing tip of the stem is often protected by a number of tiny leaves. When young, the shoot remains compact and the tiny leaves and the flowers are crowded into a compact structure called a bud.

2. DIFFERENT PARTS OF A PLANT HAVE DIFFERENT FUNCTIONS

A plant possesses different parts like the roots, stems, leaves, flowers and fruits. The different parts perform different functions. Coordination of the different functions and activities leads to the proper growth, maintenance and propagation of a plant. The teacher can help the children to understand the importance of different plant parts by suitable activities as have been described under separate sub-concepts.

2(a). THE ROOT HOLDS THE PLANT IN POSITION FIRMLY; THE PLANT GETS ITS WATER AND MINERALS FROM THE SOIL THROUGH THE ROOT

One of the main organs of the flowering plants is the root. The root absorbs mineral nutrients from the soil and thus makes the food available for the plant. It also provides mechanical support for the plant so that it can stand erect. Plants grow on soil. Soil contains water. In the water are dissolved minerals which are necessary for the plant. The teacher can help the children to understand the importance of the roots by undertaking the following activities.

Investigation

Do plants survive without roots?

Materials required
pots
bean and mustard plants
knife

Have children collect two small mustard or bean plants about 5 cm in height. Let one plant be cut just above the root and transplanted in soft soil. Let the other one be transplanted with its root intact. After a few days help the children to observe that only the plants with the root survives.

Investigation

Do roots absorb water?

Materials required
balsam and *amaranthus* plant
colouring solutions

Encourage the children to bring a few herbs like balsam and amaranthus plants, complete with roots. Have them prepare coloured water by adding red, blue or sepia colours which will dissolve in a few glasses of water. Immerse the roots of the plants in this water, and then put the plants outside in the sun. After a few hours the stems and leaves of the plants will show the colour in which they have been immersed. See Fig. 8-17.

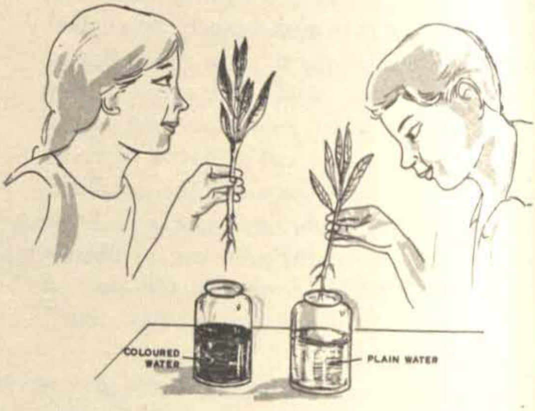


Fig. 8-17
Water enters the roots of plants and moves upwards through the stem to the leaves.

Encourage the children to ask the gardener if he can grow plants without roots.

2(b). WATER AND MINERALS PASS THROUGH THE STEM TO THE DIFFERENT PARTS OF THE PLANT

The children have learnt that roots have special functions to perform; these are absorption of water and physical support. The teacher can now help them to understand that other organs of plants have other functions to perform. For instance, the stem permits water and other products of absorption from the soil to be transmitted to various parts of the plant. The teacher can assist the students to understand the functions of the stem with the following activities.

Investigation

How do stems convey water and nutrients?

Materials required
balsam plants
glass tube
tumblers
soluble colours

Encourage the children to cut a smooth fresh stem of balsam by holding it under water as it is cut. The cut end should be inserted inside a glass tube about 10 cm long and 1 cm in diameter. The glass tube should be completely filled with water. A narrower tube should be fitted at the other end of this wide tube as in Fig. 8-18. Seal the apparatus with molten wax after filling with water. Let the narrow glass tube stand in a tumbler of water which has been coloured red. Put the tumbler in the sun. Slowly the coloured water rises up the narrow tube. Children can be helped to understand that water in the bigger tube is slowly being absorbed and conducted through the stem and evaporated by the leaves. So the coloured water in the narrow tube also rises. Study Fig. 8-18.

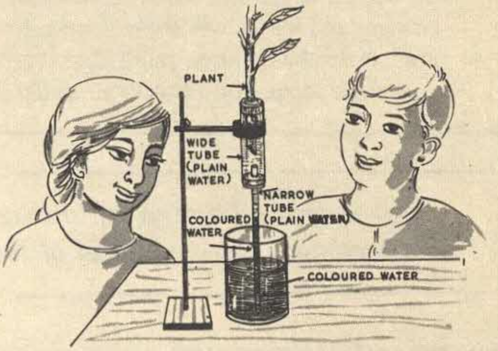


Fig. 8-18
The stem transports water and nutrients.

Investigation

How does water move into the stem?

Materials required
balsam plants
magnifying glass

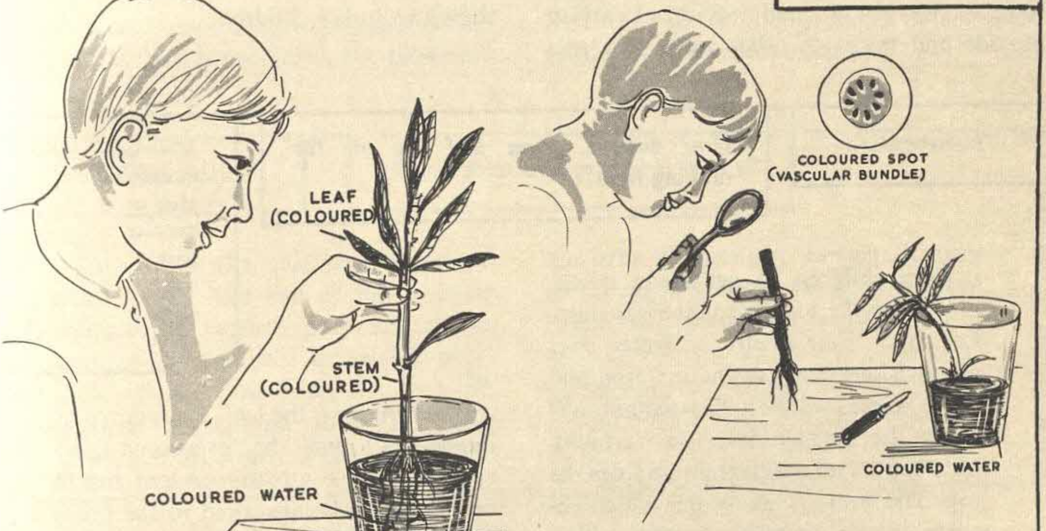


Fig. 8-19 a, b
Vascular bundles of the stem transport water and nutrients.

Allow the children to put a cut twig of balsam in water, coloured red, and keep it in the sun. After some time the stem and leaves will show a reddish tinge. Help the children put a thin section of the stem, and observe it, under a magnifying glass. They will see that the middle portion of the stem is red, indicating that red-coloured water has travelled through the stem. See Fig. 8-19 a, b.

Allow the children to cut a twig of mustard midway in the stem and see how water oozes out of the cut end.

2(c). THE GREEN LEAF PREPARES SUGAR, WITH WATER FROM THE ROOTS AND CARBON DIOXIDE FROM THE AIR

When all leaves of a plant are removed, will the plant grow? It will not. The leaves seem to have some important role to play in the growth of plants. They prepare food from the air and the soil. The air contains nitrogen, oxygen, a small amount of carbon dioxide and traces of other gases. Air gets inside the leaf through small holes present in the leaf. Water is absorbed by the roots and carried to the leaves. Inside the leaves, the carbon dioxide of the air and water are converted into a simple sugar in the presence of sunlight and with the help of the green substance (chlorophyll) in the plants. The following activities may be conducted to show this to the children.

Investigation

How does a green leaf use air for making food?

Materials required
quicklime
glass jar
tumbler
flask
wax
alcohol
iodine

Help children to get some quicklime from the building materials shop. Let them pour a litre of water over about 50 grammes of the material and shake. Gases will be generated and will escape. Let the material settle overnight. Gently pour off the clear liquid from the top. The liquid is lime-water which absorbs carbon dioxide gas. Allow children to take a little lime-water in a flask and insert one leaf of a balsam plant and seal the mouth of the flask with wax without injuring the leaf. Thus entry of outside air will be prevented and carbon dioxide already present inside the flask will be absorbed in the lime-water. After a few days take out the leaf, wash with alcohol and add a little iodine solution. The leaf will not show reaction of starch. That is, the leaf has not been able to manufacture food without carbon dioxide. See Fig. 8-20 a, b.

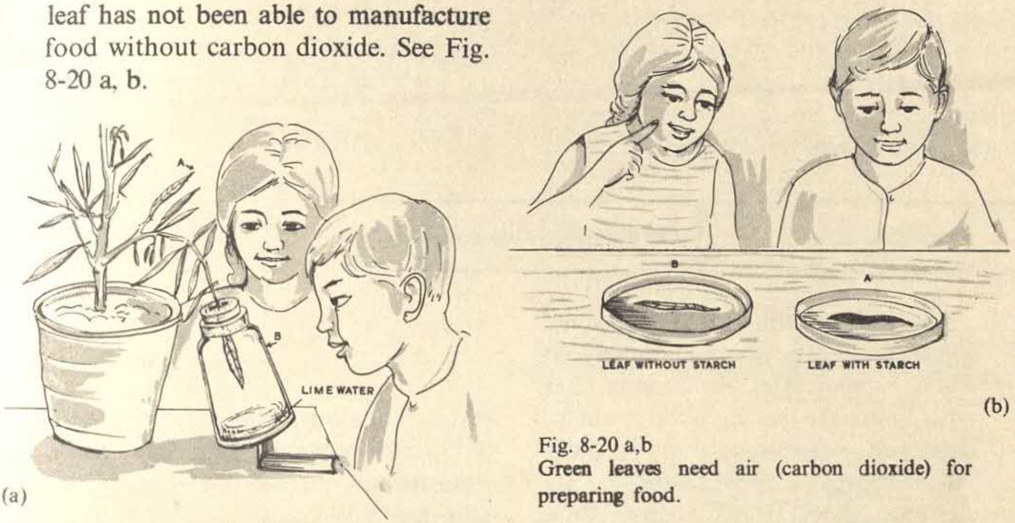


Fig. 8-20 a,b
Green leaves need air (carbon dioxide) for preparing food.

2(d). THE FOOD MANUFACTURED IN THE LEAVES PASSES THROUGH THE STEM TO ALL PARTS OF THE PLANT

Food is manufactured in the green leaves of plants. As food is produced, it is gradually removed to all parts of the plant. With suitable activities like these the teacher will be able to show the students that food in the form of sugar is manufactured by the plant and is transported to other parts.

Field Observation

How is food transported in plants?

Encourage the children to visit a palm grove. The sap of the palm is collected in earthen pots tied at the neck of the tree just below the main stalk of the flower cluster. Let the children understand that the plant manufactures sugar in the leaves with the help of sunlight, carbon dioxide in the air and water in the soil. This sugar contained in the sap travels from the leaves to the flower cluster. Because of the incision in the neck of the tree, the sap drips into the earthen pot.

Allow children to cut the stalk of sugar-cane and see sap oozing out.

2(e). MATERIALS FROM THE SOIL AND THOSE MANUFACTURED IN THE LEAVES ARE USED FOR THE GROWTH OF THE PLANT

Plants manufacture food from minerals, air and water. They do not need prepared organic food for their growth. The children can be helped to understand that plants use materials from the soil and that they prepare food in the leaves through the following activities.

Investigation

Do plants contain minerals?

Materials required
plants
pan
spirit lamp
knife

Encourage the children to get some whole plants like balsam and marigold and cut them into small pieces. Let them burn the pieces over a small, clean pan. After some time the parts will be charred, and when heated further only ash will be left. Help children realize that ash is nothing but a mixture of different minerals. These have come from the soil through the roots to the cells inside the plant.

Investigation

How does a plant use soil to grow?

Materials required
mustard or balsam
pots
soil and pebbles

Allow the children to grow two balsam or mustard seedlings in pots, one in garden soil and the other in crushed and washed pebbles of very small size. Both sets should be watered and kept in sunlight. Let them see after a few days that the one potted in garden soil is showing better growth. Garden soil contains minerals that are easily available to the roots of a plant.

Allow the children to grow seedlings in distilled or rain water which does not contain minerals. The plants will not show good growth; they may soon die.

2(f). MANY PLANTS BEAR FLOWERS WHICH PRODUCE SEEDS AND FRUITS

Flowers are important organs of a plant. They have useful functions to perform for the propagation of plants and preservation of the species. This can be explained to the students with suitable activities such as the following.

Field Observation

How do fruits grow from flowers?

Encourage the children to visit a kitchen garden growing such plants as gourds, cucumbers, peas and *crotalaria* flowers. Help the children to observe the flowers of the gourd and the *crotalaria* and the fruits in different stages of growth. At the tip of some of the fruits, the remnant of the dried flower can still be seen. Get a ripe gourd which they can rip open to see the seeds. Help the children to see that seeds and fruits develop from flowers. Let them collect also pods of *crotalaria* and see the seeds.

Let the children see plants of brinjal or chillies in the vegetable garden where they will find fruits in different stages of growth.

For Better Understanding

Living objects must have food. Different living things obtain food differently. Some get their food from organic, others from inorganic sources. The bulk of the materials found on the earth, i.e., air, water, soils, rocks, etc., are inorganic materials. Animals cannot synthesize their own food from these inorganic compounds. But plants can convert inorganic compounds into organic compounds. Animals get their food from these organic materials prepared by plants. Thus the green plant is the primary source of the world's food supply, which consists largely of the excess produced by them. How plants change the non-living inorganic matter into organic food materials and how these materials in turn are transformed into the primary living material or protoplasm, are not yet completely known to the scientists.

3. MAN OFTEN USES SEEDS TO START NEW PLANTS

Plants are useful to man because they provide food, clothes and shelter. Some parts of plants are used more than the others. For example, seeds are more useful because cereals and pulses constitute the main foods of man. All flowering plants produce seeds, but naturally not all the seeds are of use to man. Wheat, maize or rice are raised for their seeds. Once the ears are ripe, they are harvested and seeds are threshed and collected. During the next planting season, the seeds are sown and new plants are raised. The following activity will help children to understand that seeds contain 'baby plants' and from seeds new crops are raised.

Investigation

How do plants grow from seeds?

Materials required
various seeds
soil
pots

Allow children to sow varieties of seeds like rice, wheat, maize, balsam and marigold in a mixture of sawdust and sand. It should be generously watered. After a few days, small seedlings will grow. Help children realize that new plants can be grown from seeds.

Investigation

Can wheat or sunflower plants grow from leaves and stems?

Materials required
wheat plants
knife
soil

Help the children to plant a leaf, part of a stem, and roots, of wheat, gourd, sunflower and bean plants in the soil. Let them see whether or not parts of plants will ever grow into new plants.

Seeds of wild plants and those of flowers like cosmos and sunflower can be scattered in the school garden; soon seedlings will start growing.

Scientists at Work

Man continues to study photosynthesis

Man has been curious always to understand how the plants change the non-living substances into organic food materials. At first, man thought that plants obtain their food from the soil only—from the minerals present in the soil. An interesting experiment was done by a Belgian scientist, Jean Baptista Van Helmont. Van Helmont, in about 1630, dried some soil in an area to remove all water. He then took 200 pounds of this dry soil and placed it in an earthenware vessel. In this, he planted a willow plant which weighed 5 pounds.

For the next five years, he watered this plant with rain water alone and covered the vessel so that no dust could settle. After five years, he removed the willow plant, carefully scraped off all the dirt and found that the plant weighed 164 lb. He again dried the soil and found that it weighed only two ounces less than the original 200 lb. This showed that the increase in the weight of the tree could not have come from the materials in the soil. Van Helmont thought the extra weight came from the water, because he could not conceive that plants might be able to manufacture food. But by all measures, considering the time and devotion and care, it was a remarkable experiment.

Ever since that time, scientists from different countries have been experimenting to solve the mystery of the growth of plants. Priestley (1772) reported that air which has been 'injured' by burning candles would not support a living mouse. But if the mouse were kept with growing plants, the mouse would survive. In 1779, Ingenhousz demonstrated that plants 'purify' the air if they are in the light, whereas in the dark the same plant makes the air 'impure'. He reported that only green parts of plants would produce what was later called oxygen.

Thus the minds of many men in many countries were engaged in studying how green plants make their own food. In about 1862 botanists came to recognize the fact and significance of photosynthesis.

Even today, plant scientists do not know all the details of photosynthesis. Yet the problem is so important that researchers in hundreds of laboratories throughout the world continue to work on it.

The development of man's knowledge of photosynthesis illustrates one important principle of scientific progress. This is that man's knowledge is incomplete in spite of intensive research in many countries for many years. Continued attempts to understand photosynthesis will provide many problems for future scientists, including those from India, for solution.

3(a). SOME SEEDS ARE BROADCAST ON SOIL TO GROW NEW PLANTS

Crops are sown by different methods. One common practice is to grow crops like wheat or rice by sowing by broadcast method. In this way seeds are scattered on the field by hand. To use less seeds and make them heavy, the seeds are often mixed with earth. The teacher can help children understand the sowing of seeds by the broadcast method through the following activity.

Field Observation

How are seeds broadcast?

Arrange a visit to a farmer's field during the sowing season of maize. Help the children to see how the farmer mixes earth with the seeds and broadcasts them in the field. Let them visit again after three weeks and see the seedlings growing on the field. Discuss with children whether this method makes good use of seed and of land.

Allow children to draw a picture of a mustard field with seedlings growing haphazardly.

3(b). SEEDS OF MANY PLANTS ARE GROWN IN A NURSERY, AND TINY PLANTS ARE TRANSPLANTED IN THE FIELDS

Compared to the broadcast method, some other crops like rice, vegetable plants and flowers are first grown in seed-beds in a nursery. The teacher should assist the children to understand that, depending upon the plants, they are either sown by the broadcast method or grown first in a nursery and then transplanted. The following activities will show children how some plants are grown from seeds in nurseries.

Field Observation

How are rice plants grown?

Arrange a visit to a farmer's plot at a time when rice is sown. Help the children to see that in a corner of the field, where the delicate rice seedlings have been planted, the soil has been well prepared. Arrange a visit again after the onset of the rains, when the seedlings are transplanted all over the field.

Investigation

How are seedlings transplanted?

Materials required
different seeds

Encourage the children to prepare two small plots in the school garden. In one, let them sow seeds of rice, by broadcast method. In the other, let them prepare a nursery-bed for rice. Once the seedlings appear, let them transplant them. Let them observe that while the transplanted plants in the second plot show healthy growth, in the first plot the rice seedlings sown by broadcast are sickly, showing a poor growth, and they die after a few days. Help students to understand that plants with delicate roots require growing in a nursery after which they should be transplanted.

Allow children to draw a picture showing a farmer transplanting rice plants.

4. PLANTS REQUIRE SOIL SUITABLE TO THEIR GROWTH

The children have learnt that plants grow in soil. They also know that roots secure plants to the soil and absorb necessary minerals for the plant. There is a large variety of soil present on earth. Not all plants can grow on every type of soil. Soil particles as such are not assimilated by the roots. The particles contain different minerals. These are dissolved in water which surrounds them as a film—and thus get into the roots. With suitable activities, the teacher can explain the role of different kinds of soils for the growth of different plants.

4(a). THERE ARE MANY DIFFERENT KINDS OF SOIL SUCH AS SAND, CLAY AND LOAM

The earth is covered by rocks, water, sand and soil. The soil, which is essential for plant life, occurs in many different kinds. Soils are of different colours and textures. Some may be coarse; others may be fine or gritty.

Most soils contain sand and clay in different proportions. In addition, soil contains decayed organic matter. Sandy soil in mixture with clay will form loamy soil found in the garden. The following activities will help children to understand this idea.

Investigation

Are soils of different types?

Materials required
sandy soil
clay soil
loam soil
hand-lens

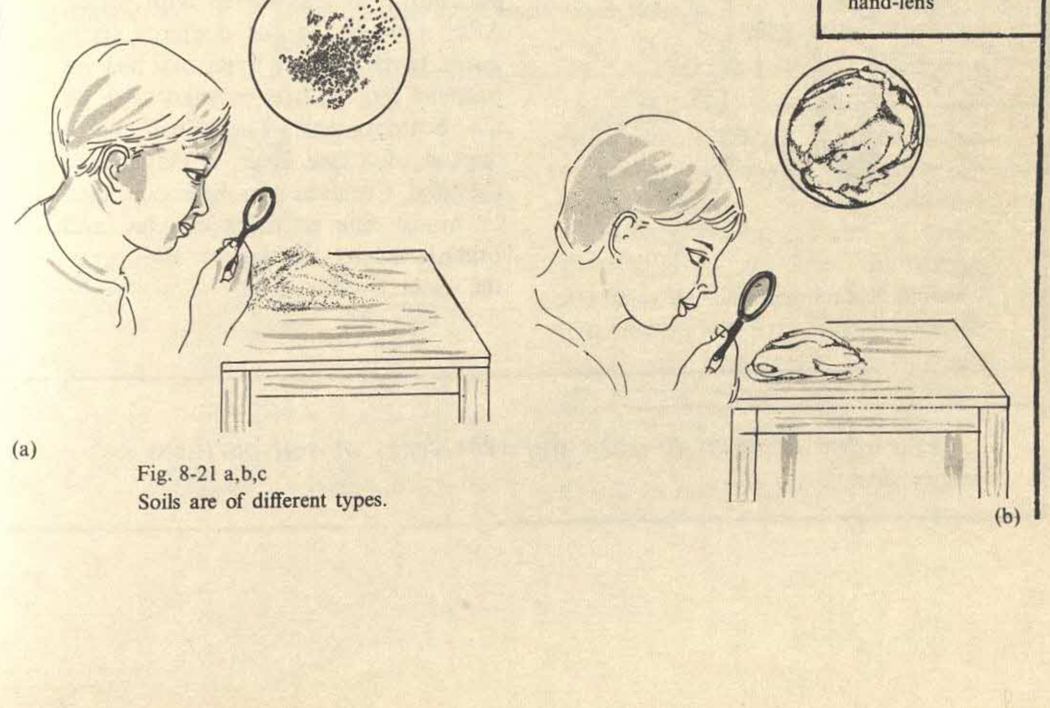


Fig. 8-21 a,b,c
Soils are of different types.

(c)

Permit children to use a hand-lens to examine samples of thinly spread soil. They will find coarse and small particles. The coarser particles will often be hard and are sand, whereas the soft, smaller particles consist of clay. Mixing sandy and clayey soil will give loam soil. See Fig. 8-21a, b, c.

Investigation

How can we see different substances present in soil?

Materials required
garden soil
glass jar
water

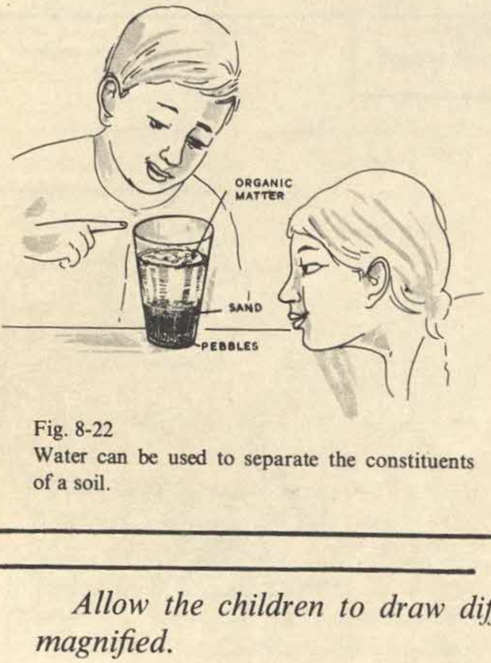


Fig. 8-22
Water can be used to separate the constituents of a soil.

Encourage the children to collect a sample of garden soil, which may be put into a jar and stirred with water. After a while, let the contents settle down. Invite children to see that heavier particles like pebbles or sand settle at the bottom first. There will be a deposit of a fine layer of clay above the sand. Children may be encouraged to notice fine particles of clay and organic matter floating on the top in the water. See Fig. 8-22.

Allow the children to draw different types of soil particles as magnified.

4(b). DIFFERENT SOILS HAVE DIFFERENT CAPACITIES TO HOLD WATER

Soils differ in the size and shape of their particles. They also differ in their capacity to hold water. In contact with water, clay becomes gummy and compact and does not let water pass through easily. On the other hand, water passes through sand very easily, and the individual particles remain separated. The teacher can help the children understand about the water-holding capacity of different soils through the following activities.

Investigation

Does clay become compact and plastic with water?

Materials required

- clay
- loam
- sand
- water
- pans

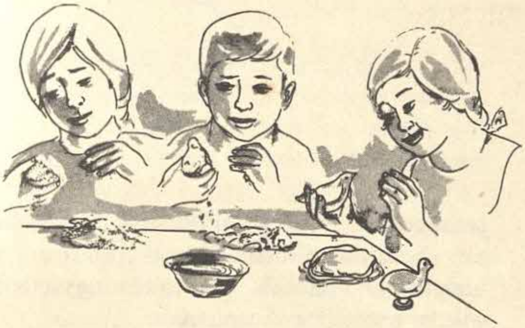


Fig. 8-23
Clay becomes compact and plastic with water.

Invite the children to form into three groups and give each a sample of sand, loam or clay. Let them mix each sample separately with a little water and knead and mould them into shapes. Let them see that sand cannot be moulded into shape but clay can be easily. Loam will be intermediate in its behaviour towards water. See Fig. 8-23.

Investigation

Different soils allow water to run through differently

Materials required

- cans or earthen flowerpots
- different soils
- water

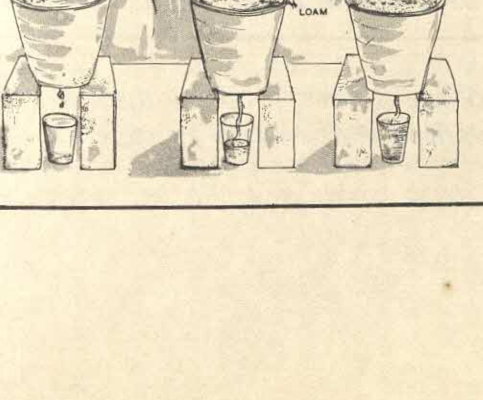


Fig. 8-24
Soils differ in their ability to hold water.

Invite the children to collect three cans and make small holes, equal in size and number, at their bottoms. Or, earthen flowerpots can be used. Fill sand, clay and loam up to the same level in the three cans. Let the children pour equal quantities of water in the three and count the running time of water in each case. Help them to observe from which soil water runs out most quickly. It is slow in loam and even slower in clay. See Fig. 8-24.

Allow the children to draw a village filter plant, with three pitchers one atop the other. The upper two pitchers contain pebbles and sand and have holes below, through which the water trickles. See Fig. 8-25.

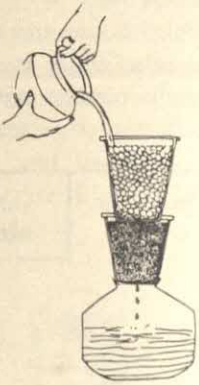


Fig. 8-25
Suspended impurities are removed as water trickles down.

4(c). SOIL CONTAINS MINERALS

Minerals are needed for proper growth of plants. A mineral is a substance occurring in the earth. It has a definite chemical composition and properties. The teacher can show the students that there are many varieties of minerals. The following activity will be useful for the purpose.

Investigation

Can we see different minerals?

Materials required
different salts
mortar and pestle
water
lemon, tamarind
tumblers

Ask children to bring to class different pebbles and stones and naturally occurring salts. These may be finely powdered. Ask them to bring materials, such as common salt, chalk, lime and alum powder. After five or six samples of powders and salts have been brought, help them to note the differences in colour. Invite children to pour a little water on them. Let them pour a little acid also, such as lemon juice or vinegar, on the powders. Some of the powders will show bubbles. Some powders will disappear when they come in contact with water or lemon juice. Help the children to understand that there are many kinds of minerals and salts to be found in soils and rocks. They have different colours. Some dissolve in water, some in acids.

Encourage children to ask the village grocer to show them various salts and minerals. Point out to them that some are crystals, others are powders.

4(d). PLANTS REQUIRE MINERALS FOR GROWTH

Green plants are capable of making their own food from minerals, carbon dioxide, and water. With the help of roots, minerals dissolved in water are taken in by the plants. With suitable activities such as those below, the teacher can help the children to understand that the minerals which are present in the soil form essential items for the growth of plants.

Investigation

How do we know that plants take minerals from soil?

Materials required
balsam plants
tin cans
sand, soil
pebbles, water

Invite the children to fill three empty tin cans, one with ordinary garden soil, another with white sand and small pebbles which have been thoroughly washed, and the third with clean water. Help them to insert three small balsam plants in each of the three cans. Put all the three cans outside in the sun and let the plants grow for at least two weeks. Water all three plants regularly. Then let children see that only the balasam plant which has been put in garden soil has grown. The other two plants are very weak or have died. Help them to understand that garden soil contains soluble minerals which become available to the plant. In the sand and pebbles, there are minerals also, but they are insoluble and are not available to the plants.

Let the children see that plants cannot grow on marbles or glass beads. Glass contains minerals, but they are not available for absorption by plants.

4(e). ALL PLANTS REQUIRE CERTAIN MINERALS IN THE RIGHT AMOUNTS

Small children may think that plants require all the minerals that are present in the soils. The teacher can help them understand that for the balanced growth of a plant, only certain minerals in proper quantities are required. All plants require certain common minerals, but the needs of different kinds of plants for minerals are different. An insufficient supply of a particular mineral often results in poor growth of a plant. The following activities will help the children to realize that plants require certain minerals in proper amounts for their growth.

Investigation

Does a difference in the dose of minerals affect plant growth?

Materials required
- potash fertilizer
- ammonia fertilizer
- plants
- pots

The children may be divided into four groups. Each group may be asked to prepare four pots with sand in which it can sow four plants: wheat or rice plants and vegetables such as cabbage or bean seeds. Help each group to get potash fertilizer or ammonia fertilizer from the grocer. This can be given to the four plants in different quantities, for instance one spoonful, one half spoonful, one-fourth spoonful and nil, to each of the four pots. Another set of four plants can be planted in a pot containing soil mixed with crushed rock. Encourage children to see the difference in the growth of the plants, depending on the dose of minerals added in the form of potash or ammonia fertilizer. Where soil has been mixed with crushed rock, the normal growth of the plant is reduced. Help the children to understand the importance of minerals by comparing the growth of plants of each group. Potash or ammonia fertilizer contain minerals useful for the growth of the plants.

Allow the children to visit two plots in a village farm, one getting a good supply of fertilizer and the other no supply of it. See the difference in growth of the plants in these two plots.

4(f). THE MINERALS FOUND IN ORGANIC MATTER ARE MORE READILY AVAILABLE TO PLANTS THAN THOSE PRESENT IN CLAY AND SAND

Although minerals are abundantly present in rocks and stone, they are not easily available for absorption by the roots of plants. The minerals must be in water-soluble form for the plants to use them. The roots can only take up different minerals in solution in water. That is why plants can grow better in soil enriched with humus, where the essential minerals are present in soluble form. Plants can absorb minerals present either in organic matter or in inorganic sources. However, they can assimilate the nutrients and minerals better from organic matter. The following activity can help in understanding that minerals found in organic matter are more soluble and hence easily available to plants.

Investigation

Organic manures are better for plants.

Materials required
- pots
- balsam

Let the children prepare two pots, one with clay and sand and the other with clay, sand, and humus. Transplant two balsam plants of equal sizes in them. Let children see after four weeks that the plant in the pot containing humus has grown very well. Since humus contains organic matter, which is readily available to the plants, they grow better.

The activity may be conducted with cow-dung and slaughter house waste manures in contrast with sandy soil.

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UNIT 8

PLANT LIFE

CLASS IV

Overview

Man is completely dependent on plant life. To imagine human existence without plants is nearly impossible. Because plants are so important to man, he finds that botany—the study of plants—is useful and interesting. Because plants provide such a large fraction of man's food, he finds it important and interesting to learn all he can about how plants themselves manufacture this food. The more he understands plant structure and function, the better can man use and enjoy plant life.

In previous classes, the children have learned about the patterns and similarities which exist among plants in spite of the great variety of plant life. They have learned something of how these similarities permit useful schemes of classification. They have learned about the specialization of parts of plants according to structure and function. They have learned not only about many of the uses man makes of plants, but also some of the ways in which he cultivates plants for his own purposes.

At this class IV level, particular attention is given to photosynthesis—the process by which green plants manufacture food from basic raw materials in the air and in the soil. Photosynthesis is a particularly important aspect of botany, as it provides man with all his plant foods and other plant materials. Indirectly, photosynthesis is the source for those foods and materials obtained from animals, and from coal and petroleum products.

At this class level students also pay particular attention to a large and important group of plants—the grasses. These provide food and other materials of many kinds for man's existence and for his enjoyment.

1. PLANTS MAKE THEIR OWN FOOD FROM SIMPLE MATERIALS

Unlike animals or man, plants can manufacture their own food from inorganic material. The higher plants have elaborate root and leaf systems. Roots absorb large quantities of water from the soil. This water contains dissolved mineral matter needed by plants. The roots also give the plant support and fix it to the soil. The leaves of plants contain certain green substances called chlorophyll which help in the production of simple sugar from carbon dioxide of the air and water from the soil, in the presence of sunlight. In the process of manufacture, carbon dioxide and water are consumed, sugar is produced, and oxygen is liberated. The sub-concepts which follow are intended to help children to understand that plants manufacture their own food from simple materials.

1(a). THE WATER NECESSARY FOR MAKING SUGAR IS ABSORBED THROUGH THE ROOTS

Water is essential for all living organisms. For plants it is all the more necessary because water is needed for the manufacture of simple sugar from inorganic materials. Roots absorb all the water which a plant needs for its activities, including that for the manufacture of sugar. The following activities may be performed to help students to understand the rule of water in the manufacture of sugar.

Investigation

Do plants need water?

Materials required
pot
balsam plants

Help the children to grow a few soft-stemmed plants like bean or balsam in pots. When the plants show a steady growth, separate them into two groups. Water one set of plants as usual, whereas the other set gets no water at all. Observe the withered plants which did not get water and let the children understand that without water the life processes cannot take place. Even the manufacture of sugar, which is an indication of this life process of a plant, stops. The other set of plants which received water have grown, which shows that all life processes continue. See Fig. 8-26.

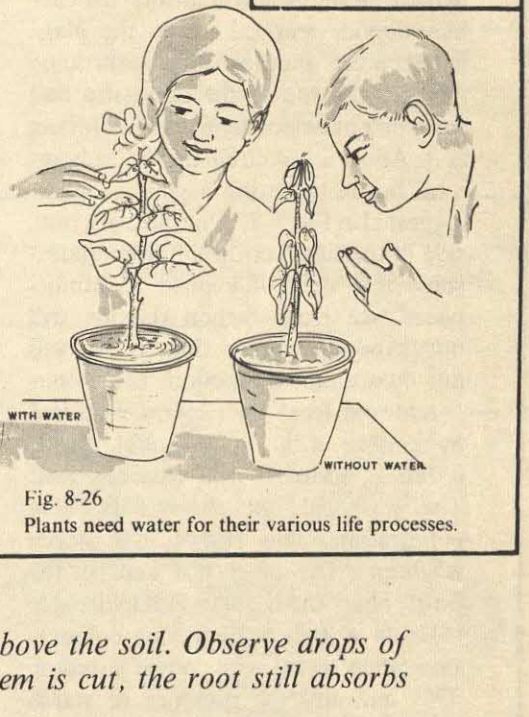


Fig. 8-26
Plants need water for their various life processes.

Cut the stem of a balsam plant above the soil. Observe drops of water exuding out. Although the stem is cut, the root still absorbs water for some time.

1(b). LEAVES TAKE IN CARBON DIOXIDE FROM THE AIR

Sugar is prepared by green plants by assimilating carbon dioxide, which is a gas obtained from the air, and water absorbed by the roots from the soil. With the following activities children can be helped to understand that the carbon dioxide of the air is concerned in the manufacture of sugar.

Investigation

Do leaves take in carbon dioxide from the air?

Materials required
potted balsam plant
potassium hydroxide
wax
alcohol
iodine solution
bottles

Allow the children to keep a potted balsam plant in complete darkness for 4 days. Let them insert one leaf of the potted plant into a glass bottle with some potassium hydroxide solution inside, and wax the cork to exclude entry of outside air. The potassium hydroxide solution will absorb the carbon dioxide trapped inside the glass bottle. Keep another leaf also in another glass bottle of the same size but without potassium hydroxide solution in it. Allow air to circulate into this second bottle by fitting a glass tube, as suggested in Fig. 8-27. Put the plant outside in the sun. Let the children understand that the leaf kept in an atmosphere free from carbon dioxide will not produce sugar; that is, it will not show a starch reaction. The colour is removed from the experimental leaf by rinsing it in hot alcohol. Next, iodine is added to the bleached leaf. The leaf will not show dark blue colouration. This shows that starch is absent. The other leaf kept in the bottle but without potassium hydroxide solution will show dark blue colouration when tested with iodine solution. This indicates the presence of starch which has been converted from sugar.

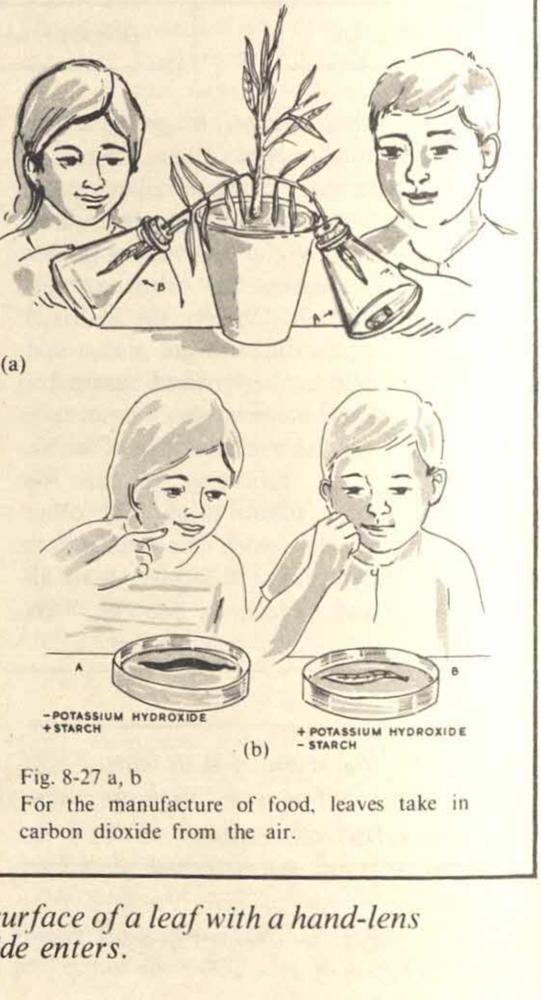


Fig. 8-27 a, b
For the manufacture of food, leaves take in carbon dioxide from the air.

Help the children to examine the surface of a leaf with a hand-lens to see the pores where carbon dioxide enters.

1(c). MOST OF THE CELLS OF THE LEAF CONTAIN A GREEN PIGMENT CALLED CHLOROPHYLL; THESE CELLS MANUFACTURE SUGAR, USING THE ENERGY FROM SUNLIGHT

Little children often wonder why leaves are green. The leaves contain a colouring matter, called chlorophyll, which is found inside leaves. The energy of sunlight is used by the chlorophyll for the manufacture of sugar from water and carbon dioxide. This sugar is later on changed into starch. The following activities can show that leaves contain a green pigment which is chlorophyll and that sunlight is necessary for the manufacture of sugar.

Investigation

Do leaves contain chlorophyll?

Materials required
leaves
mortar
pestle
alcohol
sand
muslin cloth

Help the children to form into groups and collect fresh leaves of some plants such as marigold, canna, and balsam. Grind the leaves in a mortar and pestle with some alcohol and sand. This should be strained through a muslin cloth. The children will see that the colour of the extract is green. Help them to understand that all green leaves contain this pigment, chlorophyll, which produces sugar.

Investigation

Is chlorophyll necessary for producing sugar?

Materials required
Coleus leaf
spirit lamp
iodine solution
alcohol

Allow the children to pluck a variegated coleus or croton leaf from a plant which has been kept in bright sunlight for several hours. Let them trace the boundary between the green and coloured portion of the leaf. Next, the leaf is killed with boiling water and then dropped into warm alcohol. The chlorophyll comes out in solution. Wash the leaf with water and then add drops of iodine to it. The children can see that only that part of the leaf which was green and contained chlorophyll shows blue colour, i.e., the reaction of starch. The

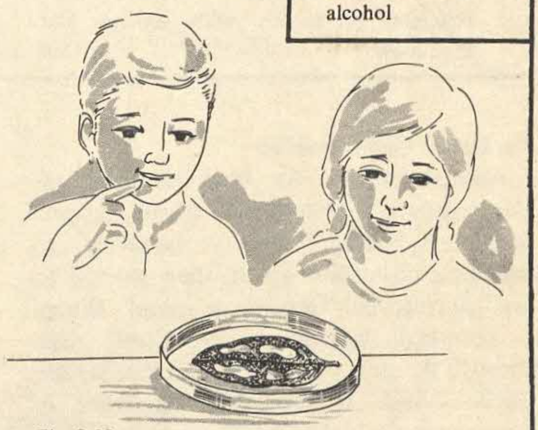


Fig. 8-28
Plants need chlorophyll to manufacture food.

other variegated portion did not contain chlorophyll and hence has not produced starch and shows no starch reaction. See Fig. 8-28.

Investigation

Can a leaf not exposed to light produce sugar?

Materials required
- pots
- black paper
- alcohol
- iodine
- balsam plant
- source of heat

Help the children to cover one leaf of a potted balsam plant with a piece of black paper. This should be done in the evening just before darkness sets in. Keep the others exposed to light. Keep the whole plant in the sun for several days. The plant is then brought to the classroom. Help the children to unwrap the black paper from the leaf. Its chloroplasts, which were green, have now become yellow. Wash this leaf, and another ordinary leaf which was not covered, with warm alcohol. Now wash these two leaves with water and add a drop of iodine solution on them. The leaf which was covered does not turn blue because it has not produced sugar, but the other leaf kept exposed to light will show the blue reaction of starch with iodine. See Fig. 8-29.

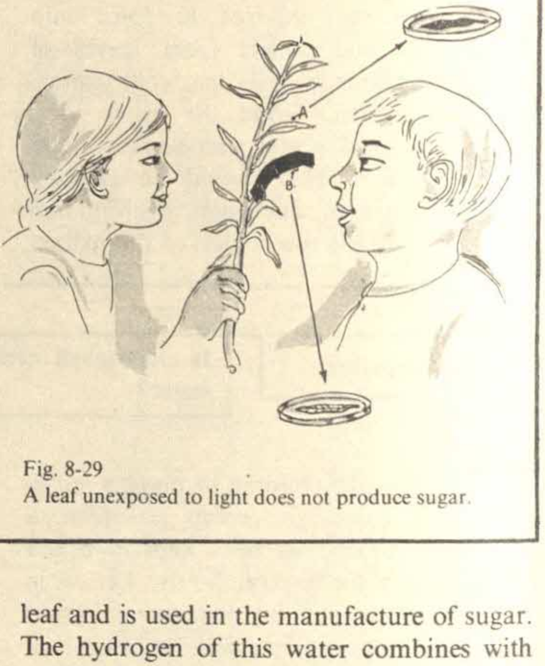


Fig. 8-29
A leaf unexposed to light does not produce sugar.

For Better Understanding

Animals depend for their nutrition on other organic matter. But plants (except fungi and bacteria) can live by using inorganic substances which they assimilate and convert into organic material. Water is absorbed through the roots and rises through the stem of the plant and reaches the leaves. Much of the water absorbed is evaporated through the surface of the leaves. But a part of this water is retained in the leaf and is used in the manufacture of sugar. The hydrogen of this water combines with carbon dioxide of the air and forms a simple sugar called *glucose*. In the process of photosynthesis oxygen is released as a by-product. The reaction of water molecules and carbon dioxide molecules to form glucose, however, is not a simple process at all. This can only take place with the help of energy and through the medium of 'helpers'. The energy is obtained from sunlight. The helpers which bind the molecule of carbon dioxide and water are the chloroplasts. It is seen therefore that the green plants have a complex laboratory in their chloroplasts for manufacture of an organic food, that is sugar, from inorganic materials. Soluble sugar produced in the leaf by the chloroplasts is immediately transformed into insoluble starch.

2. GRASSES ARE THE PRIME SOURCES OF FOOD FOR MAN AND ANIMALS

Plants constitute the main source of food for man as well as animals. But not all the plants are edible; neither can all the parts of a plant be used as a source of food. Grasses and grass-like plants supply the major part of man's or animal's need for food. Wheat, rice, barley, etc., which are consumed by man, are grass-like plants. Similarly, different kinds of grasses form the main supply of fodder for cattle. The following activities may give the children an idea of the different uses of grass by man or animals.

Investigation

Can we identify grasses?

Materials required
grasses

Encourage each child to bring two grass or grass-like plants from fields, gardens, village meadows, barns and roadsides. Help them to compare each other's collections and sort them into groups. Let them tell about the different uses of the grasses and whether they are eaten by cattle or man. Point out which parts of the plants are eaten by man or animals. Let them make a list of the grasses which are found to be useful.

Encourage the children to draw pictures of different grasses they see.

2(a). SOME GRASSES PRODUCE EDIBLE GRAINS CALLED CEREALS

The children have learnt that grasses and grass-like plants are used by animals and man as their principal supply of food. Man does not eat all the parts of such grass-like plants, but mostly the grains. The useful plants belonging to the grass group are paddy, wheat, maize and millets. These supply the grains. The following activities may be undertaken to help children realize that grass-like plants produce cereals.

Field Observation

Can we recognize edible cereals?

Encourage the children to visit a farm where paddy, wheat or millet is growing. Such a visit can be most suitably made during the harvesting season. See the ears of maize, wheat or paddy. Collect a few ears and separate the grains. Help children to open the grains with a penknife to see the kernels inside.

Allow the children to paste various grains on a piece of cardboard. Label them with their proper names.

2(b). SUGAR-CANE IS THE STEM OF A GRASS-LIKE PLANT

Children now realize that grass-like plants are of economic importance to man and animals. The useful grains are mostly collected from grass-like plants such as wheat, maize, and millets. But besides grains, other parts of grass-like plants can be used by man. For instance, sugar-juice is obtained from the stem of sugar-cane. The cane is cut and crushed to squeeze out the juice. Help the children perform the following activities which will lead them to understand that sugar is obtained from the stem of sugar-cane.

Field Observation **Is sugar-cane a grass?**

Encourage the children to visit a sugar-cane field. See that the canes look like big grasses. Collect some tall wild grasses and compare them with the sugar-cane. See the similarities in structure between a cane and other grasses. Let children cut the mature stem of a sugar-cane and bite the pith of the cane. The juice will taste sweet to them.

Encourage the children to grow sugar-cane in the school garden.

2(c). GRASSES ARE USED AS FODDER FOR ANIMALS

It is not man alone that benefits from the use of grasses or grass-like plants. Such plants prove of use to animals also, particularly to the cattle. The cattle obtain their principal supply of food from grasses. The following activities will help children to understand how grasses are useful to cattle as food.

Discussion

Is fodder obtained from grasses?

Invite the children to a farmer's house and visit the place where the farmer feeds his bullocks, cows and sheep. See the trough where food is served to the cattle. Find grass and straw cut into small bits and given to the animals as food in the stable. See a whole stalk of the fodder before it is cut into smaller bits and given to the animals. The children will find that the fodder consists of grass or straw—which is nothing but dried stalks of grass-like plants.

Allow the children to talk to the farmer and ask him about different grasses with which he feeds the cattle.

3. GRASSES ARE USEFUL TO MAN IN MANY OTHER WAYS

It is not as food alone that grasses are useful to man or animals. For instance, grasses are used for providing shelter. Grasses supply the raw ingredients which go into the making of paper. To cultivators grasses are of great economic importance, because they help in the conservation of soil. Soil from the surface of a field which is not covered by grasses is carried away by wind and rain. The teacher can quote more examples of the use of grasses and help the children to understand how this group of plants is of great use to mankind in many respects.

3(a). GRASSES ARE USED FOR MAKING PAPER

Paper, which is widely used for various purposes, is obtained from special kinds of grasses. For writing and printing, and as packing material, paper finds great use in the homes of man. The following activities will help the children to know that grasses are used for making paper.

Investigation

What are papers made of?

Materials required
blotting-paper
water
magnifying glass
lemon

Encourage the children to soak bits of torn blotting-paper in drops of lemon juice. Help children to see a small portion of the shredded paper in a drop of water under a magnifying glass. Small fibres will be seen floating in water. Help the children to understand that the fibres they see are in fact very small parts of grasses. See Fig. 8-30.

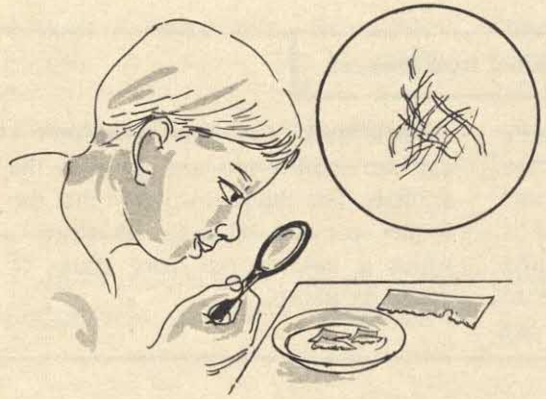


Fig. 8-30
A paper is made of fibres.

Let the children see pictures of a paper mill and its different departments.

3(b). GRASSES ARE USED AS BUILDING MATERIAL

Grasses are used as building materials also. They provide man and the animals with materials for shelter. Without grasses, it would be difficult to find an easily available and cheap material which man could use for food, shelter and other purposes. The teacher can help the children appreciate the value of grass by undertaking the following activities.

Group Discussion **Are grasses used in buildings?**

Lead the children in a discussion about the materials of which the school building has been constructed. If the school building is only a hut, the children will find many examples of the use of grass for its construction. Help them to see that the roof of the hut is thatched with palm leaves or reed or other grasses; also how the stalks of millets or rice are used as a thatching material. The pillars of the wall and the door frames are made of bamboos, which are also grasses.

Field Observation **Is bamboo a grass?**

Allow the children to visit a bamboo grove. Help them to understand that bamboos are but huge, tall grasses. Leaves and short branches grow from the sides of the tall stalk of the bamboo. The school hut often shows beams and pillars made of bamboos. Let the children look around the building and find other uses of bamboo as building material for their school.

Field Observation

Silos are made of bamboos

Encourage the children to see the storage silo of grains in the village. The simple silo is made up of split bamboos and grasses.

Allow the children to draw a bamboo grove and a village hut by its side.

3(c). GRASS RETARDS THE CARRYING AWAY OF SOIL BY WIND AND RAIN

Besides their use to man and animals—as food or source of shelter—grasses can be of indirect use to them. The teacher can encourage children to give more examples of use of this extremely valuable group of plants. Children may not know the economics or the agricultural importance of grasses in the binding of the surface of the soil. Let them understand that plants can grow only on good soil and not on barren sands or rocks. If grasses do not bind the surface of the soil, the wind and rain carry away the top-soil and render the surface of such fields barren. A simple activity as the following may be done to help the children to understand how grasses bind the soil.

Field Observation

How do grasses bind the soil?

Invite the children to join in an excursion to the banks of a river or the sea-shore, if the sea is nearby. Help children see that no plants have grown on the barren, sandy soil near the river bank or sea-shore. A little away from the bank, vegetation will occur, in patches. Most of the plants there will be grasses. Encourage the children to understand that these grasses grow only at places where there is good soil. The grasses preserve the soil from being carried away by wind by firmly fixing themselves with their roots on the soil. If the grasses were not there, the good soil on which they grow would have been carried or washed away.

Encourage the children to see pictures of grassland and barren deserts. Help them see pictures on afforestation and grass cultivation to prevent erosion.

For Better Understanding

A great problem in India is the preservation of good top-soil. Great tracts of land have been rendered useless for farming purposes because the good surface soil has been blown away by the action of wind and rain. This is the problem of **soil erosion.** Scientists make efforts to prevent the erosion of soil by cultivating suitable resistant plants which can grow on a sandy surface and thus prevent further erosion. Such plants are mostly special types of grasses, which possess the power of great penetration into the soil. Once fixed, they are difficult to uproot. These grasses act as 'binders' and prevent further erosion of the surface of the soil. Such binding grasses require protection; otherwise stray cattle and goats eat them up. Once the grasses have been able to bind a layer of good top-soil, other kinds of vegetation like small, bushy plants and herbs follow. Soon a patch of arid zone is converted into a green belt of vegetation.

Scientists at Work

Many kinds of scientists often work together on large projects

There are many people who believe that botany—the study of plants—is a descriptive science almost unconnected with other sciences like physics or chemistry or mathematics. Even though you are still in class IV, you must by now have a better idea of botany than that. You have seen that plant life also concerns chemistry, as seen in the process of photosynthesis. When a botanist is considering the way water gets into the roots of plants, and out of the leaves, and when he considers the effects of solar radiation on plant life, he is working in the field of **physics.** The study of selective growth of plants in particular kinds of soils involves knowing **geology**. Rain, seasons, temperature and length of the day and their effects on plant growth involves **weather science**. Studying patterns of plant distribution, and any kind of modern research, make use of **mathematics** and **statistics**.

One of the very interesting ways in which botanists and other scientists are at work in India is in the efforts for afforestation or growing new vegetation in arid lands. Studies of the constructional work of the peoples of the past (**archaeology**) and of present land formation (**geology** and **physiography**) lead us to believe that our nation was at one time a very heavily forested sub-continent. Many kinds of written records (**history**) show that our land had many more trees even a few hundred years ago. What has happened to these wonderful forests? Why are we now so short of wood and paper and other wood products? How might our forests of long ago be at least partly restored?

The loss of forests is one of our nation's great tragedies. What is more, it appears likely that the loss of forests has also influenced the patterns of weather. Those who study weather (**meteorology**) and climate (**climatology**) believe that water was once much more abundant here than it is now. By studying the data **(statistics, mathematics)** of rainfall for nearly a century, it is possible to see certain trends in weather patterns that are still in progress. Furthermore, coupled with the fact of lesser rainfall, even our very soil is gradually getting less and less productive **(soil science)**. Scientists who study the improvement of farming (**agronomy**) are busily at work trying to make our farms more productive with fertilizers and with improved farming practices.

Indian scientists are carrying on some very interesting experiments in the deserts of Rajasthan. They believe that forests once grew there, and that perhaps they can encourage them to grow again. So they are engaged in experimental projects of afforestation. They provide water, and some fertilizer, and begin by trying to grow special types of grass and other deep-rooted plants in selected spots. After these plants grow, the wind is less likely to blow the soil away. Once the grass and similar plants bind the soil, it is time for shrubs like acacia to be planted. When grasses and shrubs grow, the soil begins to improve. Scientists who study the natural relationships between soils, animals, and plants (**ecology**) help to introduce certain kind of animal life. Finally, some trees are introduced which will survive with a minimum of human protection.

There are many scientists at work in ways like these. They are botanists, physiologists, geologists, meteorologists, physicists and mathematicians who participate in achieving a common objective—afforesting arid lands. Thus they are scientists of many different kinds, trying to use their knowledge to improve this nation's land for the benefit of the people of India.

UNIT 8

PLANT LIFE

CLASS V

Overview

Every day, man makes use of plants in many different ways. Plants provide food and clothing, fuel and shelter, and many other kinds of raw materials. Because the plants provide food for other animals also, man is doubly dependent on plants for his very existence. It is only natural, then, that man should make a thorough study of plant life—the science of botany. It is fitting that some organized study of plant life should be a part of the curriculum of pupils in every year of the school.

In the earlier class levels of primary school, children have learned that plants exist in a great variety. But the scientists have observed patterns of similarities among the diverse groups of plants. Botanists have been able to establish an order among the groups with a useful system of classification. Botanists have also studied the specialization in structure and function of parts of plants. Farmers have learned to cultivate plants for man's use, while other scientists continue to find more and more uses for plant products.

Here in class V, students pay particular attention to some of the details of plant growth from seeds. They learn how seeds are protected from destruction and how they are dispersed over large distances. They also see what conditions are necessary for the sprouting of seeds, and through this, how farmers care for the seeds of crops they have sown. Turning still more towards the activities of the farmer, these students learn about the different conditions required for different crops, and how the wise farmers protect their crops.

Throughout all these years of primary school, teachers should keep their students' attention focused not on large lists of names of plants, of plant parts and of plant products to be memorized. Rather, they should try to give the students broad and useful general understandings—big ideas and conceptual themes—which help them really understand the world of plants. It is in such a framework of genuine understanding that necessary facts can take their meaningful place. It is in such a framework that young people can develop satisfying appreciations related to plant life.

1. MANY PLANTS REPRODUCE BY SEEDS

Flowering plants generally reproduce by sexual methods. Two sexual cells (gametes) unite and produce a cell which becomes an embryo. The embryo is contained within a structure called a seed. The seeds commonly remain on the plant until they are fully mature. They germinate and produce baby plants when suitable conditions, like moisture and warmth, are available. The following activities may be undertaken to help the children to understand that in flowering plants propagation by seeds is the most common method of reproduction.

Field Observation

Do plants grow from seeds?

Encourage the children to visit a field of such crops as millet, wheat, or paddy. Let them also visit a garden and see sunflower and cosmos or balsam plants. Collect a few samples from different plants. The children can collect some mature bean or pea plants also. They will see that rice, wheat, sunflowers, balsam, bean, and pea plants all have seeds. The children know that these seeds, on falling to the ground and receiving moisture and warmth, develop into tiny baby plants. Do they know of any other means of propagation of a wheat or a rice or a bean or pea plant besides that of propagation by seeds? Help the children to understand that most of the crop plants as well as flowers and fruit trees are propagated by seeds.

Allow the children to broadcast seeds of gram, wheat and barley. Help them to see that after a week seedlings grow out of the seeds.

1(a). A PLANT PRODUCES MANY SEEDS

When a plant is mature, it produces abundant flowers and fruits. The seeds inside the fruits are produced in greater number. Not all the seeds are utilized in producing new baby plants. Many of them are used up or wasted. For instance, edible seeds are consumed by man and birds and other animals. A number of seeds fail to germinate in the absence of suitable conditions. The teacher can help students to understand that flowering plants produce seeds in excess. The following activities will bring out this fact.

Investigation

How many seeds are there in a fruit?

Materials required
fruits and pods of coriander, sunflower, cosmos, rain-tree pea, and *amaltash*

Encourage the children to observe a coriander, a sunflower or a cosmos plant with seeds. Let them collect some pods of a pea plant and count the seeds in one pod. Help children to see that each pod contains many seeds. In pods of some trees, e.g., *amaltash* (cassia fistula) there may be many more seeds. See Fig. 8-31.

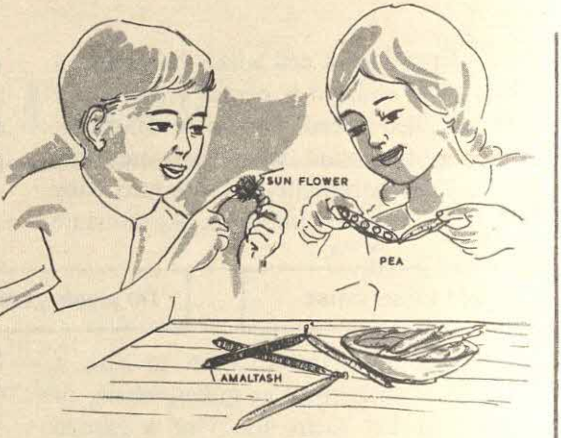


Fig. 8-31
Some plants have many seeds in each pod.

Let the children see trees like mango and coconut and count the number of seeds in a fruit. Help children to see that these trees bear many fruits, and therefore produce many seeds.

1(b). SOME SEEDS ARE TOO IMMATURE TO GERMINATE

The children have learnt that in any plant seeds are produced in excess of what is required for the propagation of the species. Such a large number ensures that even after wastage, some seeds remain for the survival of the species. Not all the fruits or seeds of a plant ripen at the same time. When such seeds are allowed to germinate, many of them fail to sprout. This is so because some of them are immature. The following activity may be undertaken to show that immature seeds cannot germinate.

Investigation

Do all seeds mature simultaneously?

Materials required
ears of wheat
ears of rice
cobs of corn

Allow the children to examine an unripe ear of wheat. See that the grains at the base are hard; they are mature. But the grains at the tip are empty. Permit children to press some grains at the tip. A milky secretion will come out of the unripe seeds. Help children understand that these immature seeds, if sown, cannot germinate. The mature, developed seeds may sprout, if sown. Let the students plant a few mature and immature wheat grains and see which ones germinate.

Let the children examine a young pod of bean or pea to see that all seeds are not mature. Some are small and wrinkled.

1(c). SOME SEEDS ARE DESTROYED BY NATURAL AGENCIES

Not all mature seeds are protected against natural or man-made hazards. Thus after harvesting of the grains, many seeds are spoiled on account of rain and excessive humidity or through intensive heat or bad storage. Again, seeds may be diseased. Diseased seeds usually do not germinate. The following activities may be undertaken to show children that many seeds are destroyed because of humidity or disease or by attack of pests.

Investigation | **Do all seeds germinate?**

Materials required
pea and bean seeds
sand
sawdust
pots

Allow the children to bring a handful of pea and bean seeds, freshly harvested from the field. Count 20 seeds each of pea or bean from the sample. Sow them in a mixture of sand and sawdust. Not all the 20 seeds will germinate; a few of them will decay. Help the children to understand that failure to germinate is the result of immaturity or of decay due to disease or to an excess of water.

Investigation | **Some seeds are destroyed by pests**

Materials required
wheat grain
paddy grain
sawdust
sand
pots

Help the children to get grains of wheat from a greengrocer's shop. They also need some paddy grain. Examine 20 seeds each. Observe that some of the seeds are shrivelled and some show small holes burrowed by insects. Help children to realize that insects and bad storage have contributed to the wastage of a number of good seeds. Let the seeds be soaked to germinate. Help children count them after a week and find how many have germinated.

Keep some cucurbita seeds in an icebox for one week. It will be seen that many of the seeds cannot germinate because of keeping them too long in frosty cold.

1(d). SOME SEEDS ARE DESTROYED BY ANIMALS

Many seeds are destroyed by hazards and consequently cannot germinate. Many healthy seeds fail to germinate because they are destroyed by birds or other animals. Here are some simple activities to help children to realize how many seeds are destroyed by animals.

Investigation

How common is it for animals to destroy seeds?

Materials required
Cucurbita seeds
maize seeds
wire-mesh

Allow the children in a class to form into two groups and help each group to count 20 healthy seeds of cucurbita and 20 healthy seeds of maize. Sow the seeds in two small seed-beds of the school garden. Cover one seed-bed with a wire-mesh, but keep the other bed exposed. After a week, small seedlings can be seen sprouting from the seed-beds. Count the two groups of seedlings which have sprung up. The number of seedlings will be less in the patch of seed-bed which has been kept uncovered because birds and rats have devoured some of the seeds and seedlings. See Fig. 8-32.

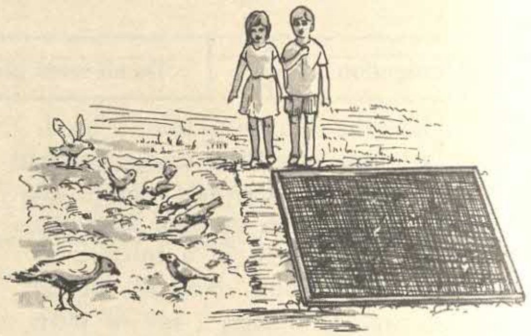


Fig. 8-32
Many seeds fail to germinate because they are destroyed by birds or other animals.

Allow the children to see fruits of papaya or guava or jamun *growing on a tree. Many will be found to have been pecked by birds and weevils.*

2. CERTAIN CONDITIONS ARE NEEDED FOR GERMINATION OF SEEDS AND GROWTH OF PLANTS

Students are by now aware that seeds play a major role in the production of new generations of most familiar plants. Seeds are formed inside fruits in most cases. Seeds germinate to produce seedlings, and seedlings grow into young plants, then into mature plants. However, there are far more seeds produced than ever grow into plants. Even if a seed is not eaten, does not decay, or is not destroyed, it still may not germinate. Many seedlings fail to mature into full-grown plants. Germination and growth do not take place properly unless certain physical conditions are present.

This major concept is broken up into two sub-concepts—one concerning germination of seeds, the other concerning growth of plants. In these students will have a chance to learn what physical conditions are necessary for the normal development of seeds into seedlings, and seedlings into mature plants.

2(a). GERMINATION OF SEEDS REQUIRES WARMTH, MOISTURE AND AIR

Even if a seed is mature and healthy, it does not always germinate, or sprout into a seedling. It will only do so if the proper conditions are present. These conditions are primarily those of temperature, moisture, and air. The complex reactions involved in the growth of new cells of the seed will not take place unless the temperature is proper. And these chemical reactions require both water and oxygen. Water usually comes from the soil in which the seedling lies. Oxygen comes from the air. In most cases, there is some air in the soil which can provide this oxygen to the seed as it begins to germinate.

All this comes as something of a surprise to students who often think of seeds as 'just growing all by themselves'. Here are some activities which can help students understand better the conditions necessary for germination.

Investigation

What are the conditions needed for germination?

Materials required
pots
sand
sawdust
seeds of bean
icebox
ice
oven
thermometers

Allow the children to divide themselves into groups. Let each group grow some seedlings from seeds in four small pots containing a mixture of sand and sawdust. Let them sow ten seeds of bean in each pot. The first group may water the first set of pots enough to keep the soil moist. The second group should supply water to the second series of pots but these may be kept in an icebox. The third series of pots should also get water, but should be kept under intense heat from the sun or, better, inside an air-oven, if this is available; the fourth group of pots may not be watered at all. A fifth group should be kept flooded with water so that the seeds can get no air. After a week, note that only the pots receiving enough water and kept under normal temperature, have shown a good growth of seedlings. Seedlings in other pots do not show good growth or the seeds have not germinated at all.

Investigation

What are the conditions for germination?

Materials required
- pea seeds
- beaker
- water
- scale

Let the children select a few healthy pea seeds. Fix three seeds on a piece of flat wood, like a scale, at an interval of 6 cm. Keep the scale with the seeds in a glass of water in such a manner that the bottom seed is submerged in water, the seed in the middle just touches the surface of the water and the third seed does not get water at all and is kept above it, as in Fig. 8-33. See that, after a few days, the seed at the bottom has germinated and a small root has come out, but it does not show any more growth. The seed at the top has not germinated at all. But the seed affixed in the middle will show good growth. It will be seen that a small root and a shoot have come out and grown. Let the children understand that the middle seed has germinated and is growing because it gets all the conditions for growth, like air, water and warmth. The bottom seed, although it gets water and warmth, and has germinated, cannot grow more because air is absent. The third seed at the top does not get water and, therefore, has not germinated. Thus, for germination certain conditions are necessary. This activity indicates that air and water are necessary for germination.

Special note for the teacher: This investigation is different from most in that it involves not one, but two variables, both in the same experimental arrangement. By clever design, the investigation permits one to find out about the need for moisture and the need for air in a single set of observations. It is possible that this may confuse some students. If this is the case, the activity can be split into two investigations, one exploring the need for water, and the other exploring the need for air. Thus, the top two seeds in Fig. 8-33 illustrate the need for water, while the lower two illustrate the need for air.

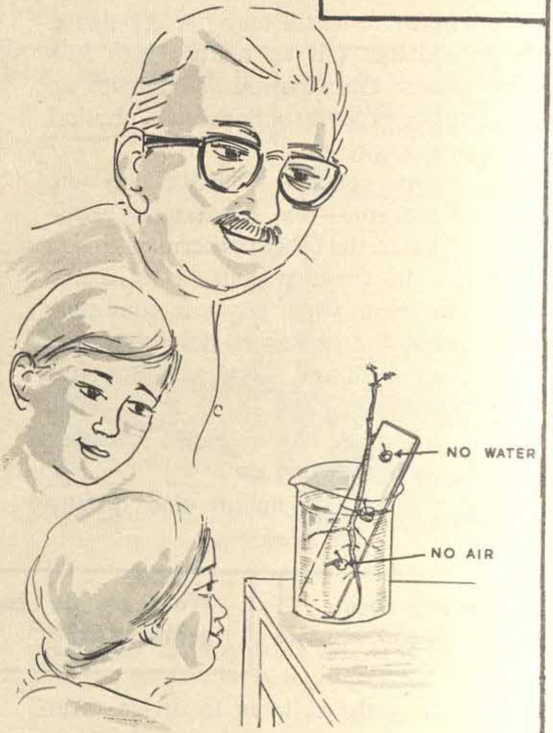


Fig. 8-33
Both air and water are necessary for germination.

The following activity helps students to explore the relationships between temperature and germination of seeds.

Investigation **Do seeds need warmth for germination?**

Materials required
- pea seeds
- sawdust
- icebox
- thermometer
- sand
- pots

Help the children to sow pea seeds in a mixture of sand and sawdust in two pots. Let both pots be watered. Keep one pot with seeds inside an icebox or inside a refrigerator, if available. Keep the other pot in a corner of the classroom and periodically water it. Note that after a few days the pea seeds kept in the pot in the classroom have grown into small health seedlings. But the seeds kept in the cold have not germinated. Help children understand that in the second case all the three factors (water, air, and warmth) which favour germination were available. But in the first case, although the seeds got water and air, it was too cold for the seeds to germinate.

Discuss with children how seeds will not germinate at all if the fields are completely dry. Have them ask their parents what happens to crops when the seeds are sown after the fields are flooded.

For Better Understanding

By definition, a seedling is a plant which has just become dependent on its own photosynthesis for food. Uptil that time it has been in the process of germination. While germinating, the baby plant has used food stored for it in the seed. It is for this reason that seeds can germinate regardless of the quality of soil present. Indeed, they can germinate in moist sand, or in the folds of a moist clean cloth. And it is for this reason that the conditions required for germination include warmth, moisture, and air, but do not include fertile soil.

Most of the cultivated plants are propagated by means of seeds. Some factors necessary for the germination of seeds are a proper temperature, air and moisture. The proper temperature for germination should be between 20°C to 45°C for many kinds of seeds. Seeds cannot germinate unless they have a supply of air. Air is necessary for the respiration of the cells of the seeds. Through respiration, the stored food materials are broken down and the broken food matter supplies the energy necessary for other life activities of the plant. Similarly, moisture or water helps the cells inside the seed to swell and then divide, thus producing many more cells. The cells form specialized groups or tissues and these develop into special organs like stems, leaves and roots for the growth and activity of the plant as a whole.

2(b). GROWTH OF YOUNG PLANTS REQUIRES WARMTH, MOISTURE, AIR, SUNLIGHT, AND MINERALS

Once a germinating seed has reached the stage of a seedling, it no longer depends on stored food for growth. Instead it becomes green and is able to manufacture its own food through photosynthesis. Accordingly it needs other conditions in addition to warmth, water, and air. The growing plant needs more than oxygen from the air. For photosynthesis it needs carbon dioxide. Photosynthesis also requires light energy from the sun, although plants can be grown with suitable artificial light. Finally, the growing plant needs the proper selection of minerals in available (water-soluble) form. These are available in fertile soil.

Thus it is seen the plants are dependent on their physical environment for many conditions. Well-selected activities such as those which follow can help students understand and appreciate this complex dependence of plants on their physical environment.

Water is an essential item which all living objects require to sustain life. The children have already learned that water is absorbed by the roots of plants and travels upwards to the leaves. No plant can live or grow without water. Besides its role in the preparation of sugar, water is absorbed by roots in excess and evaporated from the leaves, thus helping the plant to perform other life processes. The teacher can help his pupils to appreciate the role of water in the growth of a plant by conducting a simple activity such as the following.

Investigation

Do plants need water for growth?

Materials required
balsam plants
pots

Allow the children to keep two potted balsam plants of the same size outside in the sun. Water one pot as usual, but the other pot need not be watered. See how within a day or two the plant which does not get water becomes wilted. Its leaves will become dry, and droop, and the plant will not grow. The plant will recover and its leaves will soon become erect if water is poured into the pot again. Help the children to understand that if the plant is not watered for a long time, it will wilt and die.

Plants need air. Without the carbon dioxide of the air, the green leaves cannot manufacture sugar. The teacher can help the children recognize the importance of air for the growth of plants by conducting the following activities.

Investigation

Do plants grow if they do not get air?

Materials required
- pots
- balsam plants
- bell-jar
- wax
- thistle funnel with cock

Let children keep two potted balsam plants in the sun. One plant may be covered and sealed by inverting a bell-jar over the plant and sealing its sides with wax. The plant should get a supply of water from a funnel with a cock fitted at the dome of the bell-jar as in Fig. 8-34. The other plant should remain open. Allow both the plants to grow for a few weeks. After 4-5 weeks, it will be seen that the plant which is covered by a bell-jar and does not get fresh air has stopped growing.

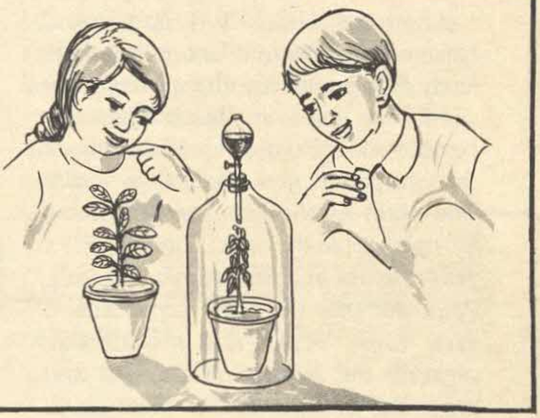


Fig. 8-34
Plants do not grow in the absence of air.

Put some sawdust and some water into a wide-mouthed bottle. Drop in three or four gram or pea seeds. Seal the bottle and keep it in the sun. Add water periodically through the funnel with cock as in Fig. 8-34. *Observe the seeds after about ten days. The seeds have germinated but the seedlings die from lack of air. See Fig.* 8-35.

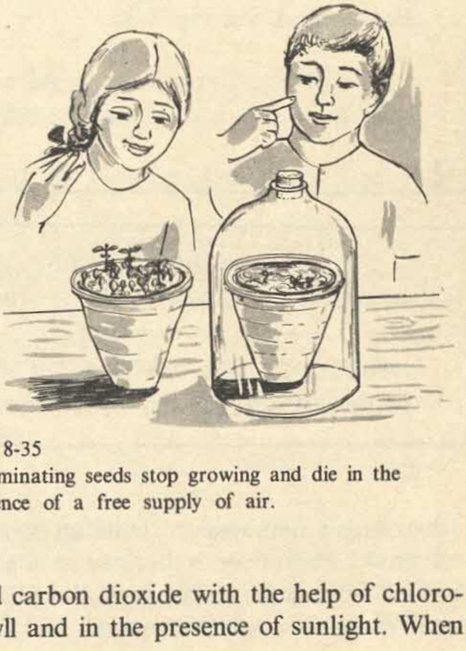


Fig. 8-35
Germinating seeds stop growing and die in the absence of a free supply of air.

The green leaves of plants contain chlorophyll. The leaves prepare sugar from water and carbon dioxide with the help of chlorophyll and in the presence of sunlight. When sunlight is not available to the plant, its leaves become yellow and the plant does not grow. By performing a simple activity, the teacher can help the children to understand that sunlight is essential for growth.

Investigation

Do plants grow without sunlight?

Materials required
balsam plants
pots
dark room

Allow the children to keep a potted balsam or mustard plant in a completely dark room. Another potted plant should be kept in the sunlight for comparison. Note the conditions of the two plants after about four weeks. The plant in the sun has grown but the one kept in the dark room will show yellow leaves and will be thin and long. Point out that the plant kept inside a dark room could not manufacture sugar in the absence of sunlight and hence has not grown. The plant stems are very thin, but have grown longer than normal. See Fig. 8-36.

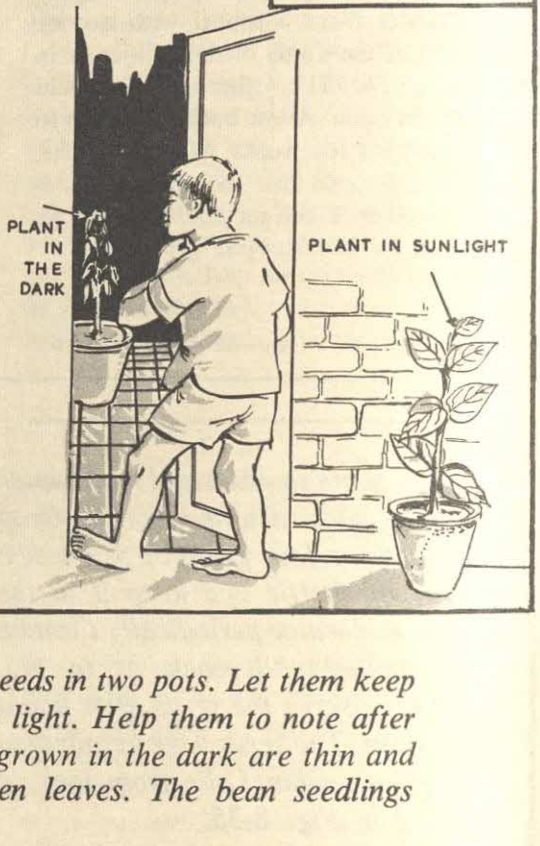


Fig. 8-36
Plants do not grow in the absence of sunlight.

Permit the children to sow bean seeds in two pots. Let them keep one in a dark room and another in light. Help them to note after 10 *days that the seedlings of bean grown in the dark are thin and weak and have not developed green leaves. The bean seedlings grown in sunlight are healthy.*

Plants require minerals to build up organs and grow. The minerals become available to them from the soil in which the plants grow. Water dissolves the minerals and this solution is absorbed by the roots and used by plants for their growth. An activity such as the following will help the children to comprehend this.

Investigation

Do plants require minerals for growth?

Materials required
bean seeds
white sand
pots

Encourage children to sow some bean seeds in a pot containing white sand collected from a shop for building materials. Thoroughly wash the sand before the seeds are sown in it. Sow a second set of bean seeds in another pot containing garden soil. Keep both the pots in the sun and water periodically. Observe that the bean seedlings in the pot containing garden soil are growing better than those in the pot containing sand. Point out that the bean seeds in the sand are unable to absorb minerals, because the minerals in the sand are not soluble. But in the garden soil, the minerals are available in solution and roots absorb them and so the plants grow well.

Invite the children to talk to a farmer and find out why he adds fertilizers to the soil. If minerals are there, the plants will grow better. Fertilizers provide well-balanced minerals needed by the plants.

3. DISPERSAL OF SEEDS IS NECESSARY FOR THE GROWTH OF NEW PLANTS AND CONTINUANCE OF THE SPECIES

A plant produces many seeds. Unless these seeds are dispersed over a wide area, the seedlings growing from them cannot show good growth. Many seedlings die when too many seeds germinate at one place. Scattering of seeds is found to be useful for healthy growth of plants and their propagation. Many plants possess special mechanisms or special organs by which such dispersal takes place. In this way seeds are distributed to new areas where they can grow better. There are many fine examples of different mechanisms of dispersal of seeds. The teacher can use these to demonstrate to the pupils that it is useful for the plants to have mechanisms for seed dispersal.

Seeds are dispersed by various mechanisms. Some seeds are carried by air and some by water. There are other seeds which have appendages like wings, hooks or hairs. These permit the seeds to be attached to animals or to drift great distances in the breeze.

3(a). WHEN TOO MANY SEEDLINGS GROW IN ONE PLACE, FEW OF THEM SURVIVE

If the seeds are not scattered but are allowed to grow all at one place, the young seedlings will grow too close together. It is likely that many seedlings will die because they will have to compete for the factors necessary for growth. With an activity like the following, the teacher can help the children to appreciate that seeds should be well dispersed if many plants are to survive.

Investigation

Do crowded seeds grow well?

Materials required
marigold seeds

Allow the children to scatter seeds of marigold plant in the school garden. In another corner of the garden, scatter a large number of seeds in a small area. Seedlings will be seen to come up in both the places. Let the children see that while the marigold plants are growing well in widely scattered areas, in the small patch of land where too many seeds were sown, the seedlings are thin and poorly developed. Help them to understand that in the small plot where there are too many seedlings, there is a keen competition for survival because minerals, sunlight and water are not available in plenty to all the plants. The seedlings have grown well where seeds were widely scattered.

Investigation

Can seedlings remain healthy when crowded?

Materials required
paddy grains
pots
sand
sawdust

Allow the children to sow 100 seeds of paddy in a small pot of about 20 cm diameter, containing soil and sawdust mixture. In another set of 10 pots of the same size, 10 seeds each of paddy may be sown. Observe and count the number of plants in all the 11 pots after four to five weeks. The seedlings in the 10 pots are growing into healthy plants. But the 100 seedlings in the first pot are not very healthy and many have died.

Let the children ask a farmer who grows jute why he weeds out every second or third seedling from the area where seedlings of jute are growing. Obviously he does not want to crowd two or three plants at one place.

3(b). SOME SEEDS HAVE WINGS WHICH CARRY THEM IN AIR

Seeds are dispersed by nature in various ways. The children may be helped to understand the mechanism of dispersal of seeds through examples. One such example is the dispersal of seeds by a floating mechanism. Here the seeds are covered by small silky hairs; or they develop parachute-mechanisms and are carried away by winds to far-away places. The following activities will enable the children to learn about the dispersal of seeds by winds.

Investigation

How are the seeds dispersed by the wind?

Materials required
Gyrocarpus seeds
Calotropis seeds
Tridax seeds

Encourage the children to see a calotropis or gyrocarpus or tridax plant when it is in bloom. Allow them to watch how the seeds drift in the current of wind because they have wings, as in Fig. 8-37, and are thus carried away far from the plant. Encourage the children to collect a few drifting seeds. Remove the appendages so that the children see the tiny seeds. Help children to understand that these tiny seeds upon germination will grow into plants.

Fig. 8-37
Some seeds like those of calotropis are dispersed by wind.

Encourage the children to say if they have seen kans *grass. The silky hairs on the seeds are useful for their dispersal by wind.*

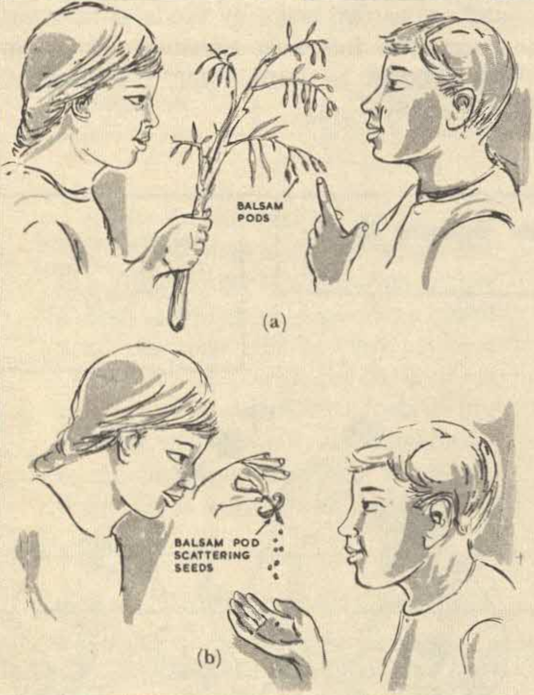
3(c). SOME SEEDS ARE FORMED IN PODS; THE WALLS OF THESE CURL WHILE DRYING AND EJECT THE SEEDS

More examples of methods of dispersal of seeds may be given by the teacher. There are some plants which develop a mechanism like a sling in their fruits. When these fruits or pods are developed and the seeds inside are mature, the pods suddenly burst. As a result the seeds inside will be scattered away from the plant, far and wide. With suitable activities the mechanism of such dispersal of seeds can be demonstrated.

Investigation

How are seeds dispersed by throwing?

Materials required
pots
balsam plants
balsam pods



Encourage the children to bring pots of balsam plants from the school garden. In the flowering season, the balsams will show flowers and fruits. Allow the children to touch the mature pod of a balsam plant. See how the pod bursts and the seeds inside are scattered over a wide area. Help the children to understand that such wide dispersal is necessary for the balsam plants to grow in different places and thus thrive better in these new places. Otherwise all the seeds would fall in the same spot at the base of a plant and compete for existence.

Fig. 8-38 a, b
Seeds of balsam are scattered widely by sling mechanisms.

Allow the children to draw a picture of an explosive pod of crotalaria, bean or balsam scattering its seeds. See Fig. 8-38 *a, b.*

3(d). SOME FLESHY FRUITS HAVE SEEDS WHICH ARE DISCARDED—AND THUS DISPERSED—AFTER THE FRUIT IS EATEN

There are many other mechanisms for dispersal of seeds. Many berries and fleshy fruits have small seeds and when such fruits are eaten by animals or man, the seeds are swallowed intact. Such small seeds are not digested and pass out of the digestive tract unharmed. Under suitable conditions, upon falling on the soil, the seeds germinate and grow into independent plants. An activity like the following may be undertaken to help the students to understand this method of dispersal of seeds.

Investigation

How are some seeds dispersed after man or animals have eaten the fruit?

Materials required
guava fruit
knife

Allow the children to cut open a fleshy guava fruit and see many small seeds inside. Help them to understand that when guavas are eaten by animals or man, the seeds are also eaten. When the droppings fall on the soil, the seeds are released and later germinate. Thus the seeds are dispersed widely with the indirect help of animals and man.

Encourage the children to see a neem *fruit which is eaten by birds. The fruit has many small seeds which are dispersed by the droppings of the birds.*

3(e). SOME FRUITS OR SEEDS HAVE HOOKS OR THORNS WHICH STICK TO THE BODIES OF ANIMALS AND ARE CARRIED FAR BY THEM

There are still more examples of other methods of dispersal of seeds; for instance, some are carried by animals to distant places because such seeds have hooks by which they are affixed on the bodies of animals. With an activity like the following, the teacher can help the students to understand how seeds with hooks are dispersed.

Field Observation

How are seeds dispersed by hooks?

Materials required
xanthium seeds
andropogon seeds

Invite the children to visit wasteland with tall grasses, and where xanthium is growing. Let them collect a few xanthium fruits and see that they have small hooks which stick to one's clothes or to the fur of animals. Help the children to examine the thorns of grass seeds which have got entangled in their clothes; these may be andropogon seeds. Help the children

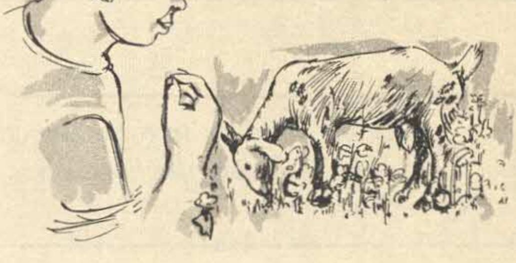


Fig. 8-39
Some seeds get carried far by affixing themselves with hooks to skins of animals or clothes.

to realize that the xanthium fruits with the seeds inside and the andropogon grains are carried away by animals or man, because these affix themselves by hooks or thorns to bodies and clothes. See Fig. 8-39.

Let the children find out from mother if any grass seeds of andropogon are stuck in the clothes delivered by the washerman. Grass seeds are dispersed in this way.

3(f). SOME SEEDS FLOAT AND ARE CARRIED AWAY BY WATER CURRENTS

Another method of dispersal of seeds is by currents of water. Some fruits have fibrous shells. When such fruits fall into the water they float, and are carried away to far off places. The floating fruits finally come to rest on the shores or banks of the river or stream. Their fibrous shells decay and the seeds germinate at this new place far away from the parent plant. The following activities will help the children to understand that many seeds are dispersed by currents of water.

Investigation **How are seeds dispersed in water?**

Materials required
pea seeds
wheat grain
guava fruit
orange
coconut fruit
betelnut fruit

Encourage the children to collect several fruits like pods of peas, wheat grains, guava, orange, a whole coconut and a betel-nut. Help them to drop these fruits in a tumbler of water, one by one, and observe which of the fruits float in water. Encourage the children to understand that the coconut and the betel-nut float on water because they have an outer covering of fibres which helps them to float. Fruits like coconut are carried very far by the currents of the river and are dispersed for germination at distant places.

Help the children to draw a picture of a coconut cut lengthwise. They may also note the fibres. See Fig. 8-5 *for longitudinal section of coconut.*

4. DIFFERENT CROPS REQUIRE DIFFERENT CONDITIONS FOR THEIR GROWTH

The teacher can introduce the subject by asking his pupils if they know where rice plants and fruit trees like papaya and guava are found growing. The children may be encouraged to discuss also where lotus plants grow. The children may observe that not all plants can grow in the same kind of soil. Some plants require sandy soil, others a clay soil. There are plants which can grow only in mud under a pool of stagnant water. Thus, depending upon the type of plant, special conditions will have to be provided for them to grow best. If the particular required conditions are not provided for a plant, it will not grow well or it may not survive at all. For example, if a cactus plant which normally grows in sandy soil in a hot climate is planted in a clayey soil where much humidity is present, the plant will perish. With suitable activities it should be possible for the teacher to demonstrate to the pupils that plants require suitable conditions for their growth.

4(a). CERTAIN CROPS GROW BETTER IN A WELL-AERATED SANDY SOIL

Ask children if they have seen a crop of ground-nut or onion growing in the field and how the soil is prepared for these crops. Those living in villages will be able to say how this is done—how the soil is made, how often the plants are watered and how the crop is cared for. A simple activity such as the one below may be performed to help the students to understand that onions and ground-nuts grow well in loose, sandy soil.

Investigation

In which kind of soil do onions grow?

Materials required
onions
ground-nuts

Invite the children to visit a field where onions have been sown. Help the children to observe that the land has been prepared carefully and the soil has been made loose. Let them see how these crops have been raised in a line on mounds and frequently the soil is turned over to keep it loose and fluffy. Help them to observe that edible parts of onions and ground-nuts grow under the soil; so, unless the soil is made loose and aerated, these plant organs cannot grow big.

Allow the children to ask a farmer how he grows sakarkand *and carrot and in which type of soil he raises them.*

4(b). CERTAIN CROPS GROW BETTER IN WET, CLAYEY SOIL

Children may know in which regions of India rice and jute grow. The teacher can ask the children if rice and jute will grow on sandy soil and if the regions they have named have sandy or clayey soil. Actual observation of these plants growing in the field will convince children that rice and jute require plenty of water to grow. The clayey soil has the property of retaining water; hence this type of soil is best suited for their growth. A simple activity like the following will show that rice grows on clayey soil.

Investigation

How are rice crops grown?

Materials required
spade
bowl
bottles

Invite the children to visit a field where rice crop has been sown. Encourage them to collect samples of soil from different areas of the field. Let them feel the soil by hand. The soil may be mixed with water and kneaded into shapes. Help the children to see that the soil is clayey and has a great capacity for holding water. Because of their need for water, rice plants can grow in this clayey soil.

Let the children talk to a farmer and find out in which type of soil jute grows.

4(c). VEGETABLE CROPS GROW WELL IN A SOIL RICH IN ORGANIC MATTER

The children can be given more and more examples of soil as suited for the growth of a particular crop. Another group of plants, the garden vegetables, need a different kind of soil. Vegetables grow very rapidly and the medium on which they grow should, therefore, be able to supply enough minerals and salts quickly for such plants to grow. Organic matter like dead leaves, compost, cow-dung, etc., contain a rich supply of readily available minerals for these plants. Therefore, vegetables grow well in a soil where such rich organic matter is available. The following activity may help students to understand that vegetable crops grow better in a soil rich in organic matter.

Investigation

Which kind of soil is best for vegetables?

Materials required
spinach
manure
spade

Encourage children to prepare two small plots of the same size in a garden. Let them grow spinach in both. One plot may be generously manured with compost and farmyard manure. Help the children to see that spinach plants which have obtained a supply of organic manures are showing luxurious growth. The plants in the second plot, containing no organic manure, are less well-developed. Help children to understand that vegetables need a rich supply of organic matter and hence grow better in a soil which possesses such organic matter.

Encourage the children to ask the gardener what kind of manures he uses to grow cabbages and beans.

4(d). MELONS GROW WELL ON THE SAND OF RIVER-BEDS

Many vegetables and fruits are luscious and contain plenty of water. For the growth of such plants a constant and plentiful supply of water is necessary. At the same time, the plants should not be waterlogged because they might decay. Many plants like melons and gourds have weak stems and cannot stand erect. So while plenty of water is needed for these plants to bear fleshy fruits, the other parts of the plant like roots, stems and leaves should not remain submerged in water. With a simple activity as the following it may be shown that a sandy soil and a good water-supply are necessary for melons to grow.

Field Observation

Where do melons grow?

Help the children to arrange an excursion to a river-bed where gourds and melons are growing. Help them to examine the sandy soil there. Let them dip their finger in the soil and feel that the surface of the soil appears dry, but a few centimetres beneath the surface the soil is moist. Explain to them that the melon is a plant which trails on the ground, and has a weak stem which decays if it remains under water. Therefore, the dry surface of the sandy soil suits its growth. At the same time, the plant should have a plentiful supply of water for its fruits to become juicy. The sandy soil of the river-bed provides these conditions for the melon plant to grow well.

4(e). TEA AND COFFEE PLANTS GROW WELL ON MOIST, SLOPY HILLSIDES

Tea and coffee are beverages made from the leaves of tea plants and powdered seeds of coffee. Unless he comes from the hill regions, it will be very difficult for a child to see a coffee or a tea plant. The teacher can, however, point out to his students in the geography lessons, hilly regions in the map where the rainfall is heavy. In the hilly tracts of India, in the east as well as the south-west, it rains profusely. Because of the hilly nature of the area, the rain water does not collect there but flows downwards.

Soil in these regions is, therefore, constantly moist. The moist soil and humid weather are suited for the growth of particular types of plants, like tea and coffee. With an activity like the following the teacher can help the children to understand that the tea and the coffee plants grow in rainy areas and on sloping hillsides.

Group Discussion **Where are tea and coffee grown?**

Let the children see several pictures of tea or coffee plantations. They will see that these crops grow on slopes of hills. Do the children know which are the most rainy areas in India? Encourage them to identify the coffee- and tea-growing areas from an atlas with those places where it rains most. Help them to understand that although it rains heavily at these places, because of the sloping nature of the ground, the water never collects at one place and the plants are, therefore, only bathed in water.

Encourage the children, who are living in hill regions, to bring a twig of a tea or coffee plant pressed between old newspapers when they return to school after their vacation.

4(f). SOME VEGETABLES REQUIRE A COOL CLIMATE; THEY ARE GROWN IN WINTER ON PLAINS AND IN SUMMER IN THE HILLS

The temperature plays an important part in the growth of plants. Thus plants growing on the same kind of soil in areas with similar rainfall but cooler temperature will not grow if the temperature is higher. The winter vegetables like the cabbage, cauliflower or the pea are examples which show how temperature influences the growth of these plants. The cabbage, cauliflower, and the pea are available in the plains in winter only. But in the hills, where the temperature is cooler, these vegetables grow in summer, when it is not possible to grow them in the plains because of the high temperature. With an activity such as the following, students can be helped to understand that some vegetables grow only when the temperature is not too high.

Field Observation **Do all vegetables grow all round the year?**

Invite the children to join an excursion in winter to the fields where vegetables are grown. Show them cauliflower, carrots, and peas. Visit the same vegetable plot in summer. Different vegetables like radish or *bhindi* will be seen growing during this hotter season. The temperature helps to determine the variety of plants growing.

Discuss with children why winter flowers are called seasonal flowers. It is because these flowers grow only in the cold season.

5. CROPS REQUIRE PROTECTION

Man raises different crops for his food. Unless the crops are protected from insects and animals or from unfavourable weather, they will be damaged. A damaged crop can never give a good yield. At every phase of growth, crops have to be tended with great care. If not properly cared for or protected, the yield of the crop is affected or it is destroyed because of the unfavourable conditions. The children have seen caterpillars or aphids infesting leaves and pods of common vegetables. Unless these insects and vermin are killed they will destroy much of the crop.

5(a). CROPS NEED PROTECTION FROM MANY ANIMALS THAT CAUSE DAMAGE

It is not enough to cultivate a crop; it also must be protected. If it is not properly protected, it is likely that many of the plants will be destroyed by animals or insects. Many animals depend on plants for food. These animals do not distinguish between a cultivated crop and wild plants for food. Whenever they get an opportunity, cattle and goats destroy cultivated crops. Similarly rodents like rats or squirrels destroy many fruits or grains. With suitable activities such as the following, children can be helped to understand that unless properly protected, much of the crop is destroyed by various animals.

Investigation **Do animals damage crops?**

Materials required
brinjals
peas

Permit the children to collect brinjals and peas from various fields with the permission of the farmer. When cut open some of the specimens will have insects. Identify the plot on which these vegetables were growing. Help the children think of some remedy for destroying the insects in it.

Field Observation **Are some fruits spoiled by animals?**

Allow the children to pluck guavas or plums. Quite a few of them will be found to have been bitten by squirrels. Help children to realize that squirrels destroy many fruits.

Field Observation

Some fruits are destroyed by birds

Material required
papaya fruit

Invite the children to visit a papaya garden. Ripe papayas are seen on the trees. A few fruits have been pecked by birds. Help the children to discuss how the papaya fruits can be protected against birds.

Permit the children to see how young plants in a park or on the roadside are protected against goats or stray cattle by building a fence around them.

Discussion

Goats destroy crops

Goats and cattle are sometimes not allowed to roam freely in a field but are tethered. Discuss with the children the reason for this—if let loose, these animals will eat and destroy much of the crop and other plants.

Discussion

Jackals also destroy plants

Jackals are animals which come out mostly at night. They eat dead animals and underground parts of plants like corn or fruits like the jack-fruits. Help the children understand that unless these plants are protected, many of them may be destroyed by jackals.

Scientists at Work

India makes increasing use of scientific agriculture

Imagine yourself to be a wheat farmer. Suppose you see a brown cloud coming toward your fields. What can it be? It is a swarm of locusts—millions and millions of hungry insects which are about to have their meal in your field. In half an hour you may not have a basketful of wheat left. Surely you must wonder if science can do something to help you.

Millions of tons of crops and plants are damaged by locusts every year. Locusts destroyed crops and caused human suffering even in ancient times. The control of locusts today presents a feature in the international cooperation of scientists of various countries. Even today locusts cause a world-wide loss of about 30 crores of rupees per year.

Locusts are fast moving insects. They are related to grasshoppers. The adult locusts form moving swarms, covering a large territory. In Africa, a swarm of locust covered an area 18 × 10 miles and consisted of approximately 10,000,000,000,000 individual insects. The swarm travels great distances, sometimes 1500 miles in a straight line. Locust swarms can occasionally be seen in the Delhi-Rajasthan area.

Locust control has been a fascinating multi-national effort. Scientists have dug the earth and killed eggs; they have forced 'hoppers' into slit trenches and destroyed them there. Even steam-rollers, poison gases, flame-throwers, bacterial diseases, balloon barrages, smoke-screens, artillery—and other devices of modern warfare—have been used against swarms of locusts. Sometimes locusts are destroyed by spraying them with lethal dusts and liquids from low flying aircraft. These are examples of chemical control of pests.

In the years before and after World War II, scientists from Britain, France, Belgium, India, South Africa and U.A.R. established laboratories in several locust-producing areas of the earth. They have achieved tremendous success in the control of this pest through international cooperation.

Weeds are unwanted plants. They occupy space meant for useful crops; or they may be poisonous to domestic animals and man. They are killed by various methods. A most interesting method of controlling weeds is the biological method, where other plants or animals are introduced to control the unwanted weed.

Children in India know the prickly pear which is a weed growing in many places in the country. In Australia, the prickly pear became a serious pest. In 1925, it was estimated that 60 million acres of land in Australia were covered by this weed. In 1930-37, the Australian scientists sought to control the weed by introducing some insects from other countries which grow only on prickly pear. Several countries, notably America, experimented with various insects and ultimately a dozen promising insects were released by the Australian scientists in different parts of the country where the weeds grew. One kind of moth was found useful. It devoured the inner tissues of prickly pear and destroyed the stem. By 1933, almost all the vast areas of prickly pear were destroyed by this single moth. About 22 million acres of cultivable land have thus been recovered through the help of the moth.

This shows a remarkable achievement by scientists in controlling weeds. It also shows what great damage can be caused to plants by smaller animals. Imagine locusts and other insects devastating crop plants while prickly pear and other weeds dominate the fields. Very soon man would face famine!

As you know, in our country too we have problem of weeds and unwanted plants. The water-hyacinth in the plains and the *kans* grass in northern regions of India have proved to be weeds which cause great loss to the crop. Perhaps, some of the little children who are reading general science now, will be able to find some effective control of these weeds. It may be some chemical or biological control which will greatly help in the agricultural improvement of our nation.

5(b). FUNGI, BACTERIA AND VIRUSES DAMAGE CROPS

Cultivated plants are destroyed also by the lower groups of plants. For instance, bacteria cause more damage than animals. With suitable activities the students may be shown how bacteria or virus attack and destroy the crop plants.

Field Observation

Can we see virus disease in potatoes?

Materials required
potato leaves

Allow the children to visit a potato crop. They will see some plants which have crinkled and shrivelled leaves and are stunted in their growth. Help the children to understand that these plants have been attacked by virus. Unless the plants are controlled by destroying the diseased ones, the disease spreads to other healthy plants and these plants also die. By evolving special varieties of potato plants, which are resistant to the attack of virus, the spread of the disease can be checked.

Field Observation

Bhindi and brinjals are attacked by fungi

Materials required
brinjal plants
bhindi plants

Invite the children to visit plots where brinjal or *bhindi* are grown. Let them see some plants which have been attacked by fungus. Such plants show wilting and are drying up. If there are fruits, the fruits are shrivelled. Fungi are great killers of crops. Help the children to understand that to protect crops from fungi, either disease-resistant varieties are to be evolved or chemical substances, which kill such fungi, are to be spread on plants.

Permit the children to draw pictures of the tobacco mosaic virus.

5(c). SEEDS ARE PRESERVED BY DRYING AND STORING IN CONTAINERS WHICH ARE WATER-PROOF AND VERMIN PROOF

Grains are collected after harvesting the crop. Unless they are properly stored, much of the crop is lost. The waste may be due to dampness and moisture, or the insects may eat much of the grain. Ask the children if they know how wheat or rice grains are stored in houses. When grains come in contact with water, they swell and germinate, or in excess dampness they rot. Therefore, it is necessary to store grains securely, well protected against vermin and moisture. The following activity will show the importance of proper storage for the protection of seeds against vermin and humidity.

Investigation

Can children find out insect-eaten grains and pulses?

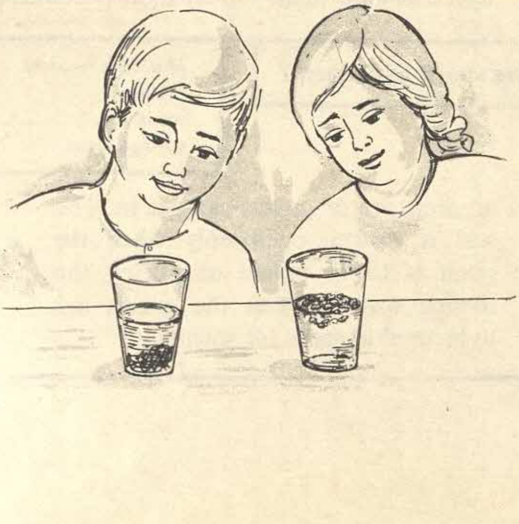
Materials required
gram seeds
bean seeds
wheat grains
rice grains

Invite children to visit a grocer's shop and collect samples of grams, beans, grains of wheat and rice. Can they see any insects in the grains or do they find any grains partly eaten away by insects? Help the children to realize the importance of storing grains in air-tight containers and not in sacks as in many grocer's shops. When the grains are to be stored for a longer time they should be properly stored and kept safe from the attack of the insects.

Investigation

Does moisture spoil seeds?

Materials required
gram seeds
wheat grains
rice grains
bottles



Invite children to bring three types of seeds like gram, wheat and rice. Place these seeds in small glass bottles and pour some water in the bottles. Let the seeds soak for some time and

Fig. 8-40
Moisture spoils seeds.

then drain off the excess water and close the bottle. Keep the bottles in the dark. Examine them after fifteen days. Note that the gram, wheat and rice seeds have decayed and become unfit for consumption. The moisture in the closed bottles had caused the seeds to decay. Help the children to realize that if seeds and grains are to be stored for a long time, it is necessary to keep them dry. See Fig. 8-40.

Field Observation

How are rice crops threshed and how are the grains stored?

Invite the children to visit a farmer's house during the threshing season of wheat or rice crop. Help them to see how the grains are threshed. They are threshed in a courtyard which is clean and dry. They are stored in bins and kept in a dry place inside the farm house.

Ask the children to store small bags of wheat or rice or gram or bean on a moist floor of the cow shed and observe them after fifteen days. The grains will be spoiled and will be rotting.

5(d). STORAGE BINS (*khatti*) ARE SEALED TO KEEP OUT INSECTS AND VERMIN

Children know by now that unless a crop is protected against moisture or against animals or disease, much of it is wasted. The teacher can encourage the pupils to see the actual process of storage of foodgrains. An activity like the following can be undertaken to show how seeds and grains are stored in water-tight and air-tight containers.

Field Investigation

How are grains stored by farmers?

Materials required
grains
seeds
storage drum

Encourage the children to visit a large godown of a farm in which grains and seeds have been stored. Let the farmer himself talk to the pupils and show how he keeps his grains well stored. The seeds are kept in big bins and then covered and sealed so that no moisture or insects can get in. The seal is broken open only when the grain is to be milled or during the sowing season, when the grains are to be used as seeds for sowing.

For Better Understanding

Crop protection is of great importance to our country, particularly when there is a great shortage of foodgrains in the country. It has been estimated that between 10 per cent and 25 per cent of the total grain produced in India is wasted because of rodents, birds, insects or improper storage. The total import of foodgrains in the country is thus almost equal to the amount which is wasted. If all this waste could be stopped India would not need to starve for food or import food from outside.

A visit to the agricultural advisory office will show many kinds of plant protection equipment. One very important type of plant protection equipment is the spray-gun which is operated manually or may be power-driven. In advanced agricultural communities, spraying is even done by aeroplanes and helicopters. The spray often consists of a weak solution of copper salt and lime. Some recent organic compounds which contain sulphur are also used as insecticides or fungicides. Plants, particularly their leaves, are thinly sprayed to kill the fungi or the insects. If, however, a crop is affected by a fungus attack in the root, a fungicide cannot help much. When crops are attacked by virus, the common method of control is to eliminate the affected plants.

The best method of protection of plants against fungus, bacteria or virus, however, is to breed disease-resistant plants. Plant breeders are continuously evolving newer varieties of economically useful and disease-resistant plants. New disease-resistant plants of wheat, maize, sugarcane, etc., have been evolved and are widely cultivated by progressive farmers in India.

UNIT 9

ANIMAL LIFE

CLASS I

Overview

Every child has a natural curiosity to watch animals and their activities. His environment abounds in living animals of different kinds. Even before entering school he has gained some knowledge of animals. However, his knowledge is not organized. It consists of bits of information about the most common animals which he has seen in his immediate environment. For example, he knows that cows are four-legged animals that give milk. He knows that snakes are crawling animals often brought by snake charmers and occasionally found in gardens and fields. He has gained his knowledge through casual observation, talks with his parents, playing with pet animals and through seeing the pictures of animals in books.

Here in class I, children are introduced to the different kinds of common animals in an organized way. Thus, after having been acquainted with the common animals, they are helped to understand the general structure of animals. Then the children are led to recollect the basic necessities of animals, namely, food and shelter.

One of the main scientific ideas found in this unit for class I is the *DIVERSITY* in the animal world. There are so many different kinds of animals in this world. Some of these animals closely resemble one another. These 'like' animals are put together and thought of as a group. There are many groups of animals. Children can acquaint themselves with the most common groups. The diversity of animals shows up in the differences in their body features. Thus another scientific idea in this class is the special features of each kind of animal. Because of these body features different animals have different modes of life. This is reflected in the basic necessities of life of animals. The type of food an animal eats is reflected in the nature of its body parts. Animals also need to be protected against wind, rain, heat and cold.

In this unit, the teacher should help to widen the interest of the children in animals, which they already possess. They should also develop the habit of observation. No formal teaching is expected at this stage. The teaching-learning activities will consist of observations followed by discussions. The children should be guided to become more and more curious about animals. The teacher should also try to build up in the children a usable vocabulary of names of common animals. The bits of information the children have, should be continuously organized as knowledge.

In short, the unit on Animal Life should enable the children to appreciate nature of which animals form a part, and to live with it.

1. ANIMALS OF VARIOUS KINDS EXIST IN THE ENVIRONMENT

The environment abounds in living organisms. Some of them are plants and some animals. Animals differ from plants in many respects. Animals move from one place to another while plants are fixed. The majority of plants are green in colour. Animals are of different colours, but not generally green.

Elephants, camels, horses, cows, buffaloes, rabbits, squirrels, rats, fowls, pigeons, crows, turtles, crocodiles, snakes, calotes, frogs, fishes, honey bees, ants, flies, and earthworms are some examples of animals. Some animals like cows, sheep, dogs, cats and fowls live in close association with man. Many animals are found most commonly in our environment. Wild animals like lions, tigers, bears and wolves are found in forests. These animals are sometimes captured by man and kept in zoos and circuses.

All animals are not of the same kind. They differ from one another in different ways. They vary in their sizes, shapes, body covers, colours and behaviour. Different names are given to different kinds of animals.

The teacher can help the children to appreciate the vastness of the animal world, diversity of forms, etc., by frequently taking them out into the fields, gardens and forests. As the children begin to learn more about animals, their interest will extend beyond the classroom activities. Taking the children outdoors will help them to see animals in their natural surroundings. This will serve to clarify and make more vivid the experiences which the children get while learning about animals within the school.

1(a). THERE ARE MANY COMMON MAMMALS IN THE ENVIRONMENT

Children are familiar with various pets and domestic animals. Some examples of pets are dogs, cats and rabbits. Cows, buffaloes, and horses are domestic animals. All these animals give milk to their young ones. All such milk-giving animals are called *mammals*. The following activities will prove useful to enable the children to know more about these kinds of animals and to create interest in watching them.

Discussion

What are mammals?

Materials required
pictures of mammals

Ask each child to tell the name of a mammal he has at home or has often seen. Tell the children that mammals are animals that give milk to their young ones. Write the names of these on the blackboard. Encourage the children to say a few words about each of these animals. Help them to give the names of animals that are not mentioned by other children. Count the different kinds of animals which the children know. Show them pictures of these animals. Ask the children to spell out and read together the name of each animal from the blackboard.

Field Observation

What mammals can we see near the school?

Take the children out on a visit to the neighbourhood of the school. Show them pets and other mammals. Ask the children to give the name of each mammal. Let them also state the colour of the animal. Encourage other children to mention the different colours in which they have seen these mammals. Point out to them the modes of feeding the young ones. Ask them to count the different kinds of mammals they have seen on their trip. Ask each child to tell which mammal he likes most.

Class Project

Let us have a pet show

Arrange a show of small pet animals in the class. Help each child to see, feel and smell each animal. Caution them to handle them gently. Encourage the children to observe their ways of life like feeding, cleaning their own bodies, fondling the young ones, etc. Blindfold one child at a time and give him an animal. Help him to find out what kind of animal it is from its touch and smell. See Fig. 9-1.

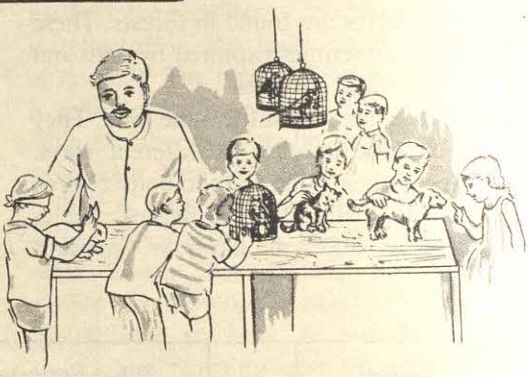


Fig. 9-1
Animals can be identified by the size and shape of the body, or by feeling the skin, or even by the animal's smell.

Write or collect short stories about animals from books. Tell these to the children with suitable actions.

Collect coloured pictures of mammals from old books or magazines. Cut them out and make an album. Show them to the children. Exhibit coloured wall charts of mammals in the classroom. Help the children to identify each mammal.

For Better Understanding

Mammals give birth to young ones, which resemble their parents. The young ones suck their mothers' milk. The bodies of mammals, in most cases, are covered with hair. Most of the mammals are land animals. A few, like whales, porpoises, sea-cows, and others live in water. These aquatic mammals have a smooth body without much hair. Their limbs are modified and adapted for swiming in water. Examples of some mammals are rats, rabbits, squirrels, monkeys, elephants, tigers, lions, wolves, foxes, bears, etc. Man is a mammal.

1(b). THERE ARE MANY KINDS OF BIRDS ALL AROUND

Many different kinds of birds exist on this earth today. Many are beautifully coloured. Some birds like parrots, mynas, partridges, and bulbuls are kept as pets by man. Birds like chickens, crows, ducks, and sparrows are most commonly seen in villages and cities.

Children can be helped to develop an interest in observing and learning more about birds through the following activities.

Discussion **How many different birds do we know?**

Ask each child to mention a bird which he knows. Let him say whether it is a small or a big bird. Ask him to speak a few words about its colour, what it eats and where it is found. Find out the number of birds the children know. Show them pictures of birds, if available.

Field Observation **What can we see in a poultry yard?**

Take the children out to a village nearby. Show them the fowl in a poultry yard. Let them observe the birds, their body colour, their food and feeding habits. Let the children feel the body and the feathers of a fowl. Let them observe the difference in the nature of the feathers of hens and cocks, hens helping the chicks to find their food, and hens raising an alarm when somebody goes near the chicks, etc.

Encourage the children to observe the feathers of different kinds of birds. Help them to identify the common birds through their feathers, whenever possible.

For Better Understanding

Birds differ from mammals in many respects. Birds have beaks. Birds have feathers as body covering. Mammals have hair covering their body. Birds lay eggs. Mammals give birth to live young ones. The young chicks of birds are not given milk by their mothers. The young ones of mammals suck their mothers' milk.

1(c). THERE ARE MANY KINDS OF INSECTS

There are far more different kinds of insects than all kinds of animals combined. There are butterflies, mosquitoes, houseflies, ants, bees, etc. Some of these are useful while some are harmful to man. The following activities can help the children get to know the most common insects on earth.

Field Observation

How can we collect insects?

Materials required
insect-collecting nets
wide-mouthed bottles
cloth

Take the children to a nearby field. Take a few insect-collecting nets and about six wide-mouthed bottles.

An insect-collecting net can be made out of mosquito curtain cloth. It is stitched in the shape of a wide-mouthed conical bag. The wide mouth of the bag is stitched to a circular wire ring. A handle is attached to the metallic ring. See Fig. 9-2. Help the children to collect insects by a sweeping movement of the net aimed at an insect or groups of insects. The insect gets into the bag. Let them carefully transfer it to the bottle and examine its colour, shape, etc. Let them cover the mouth of the bottle with a cloth to allow the passage of air inside the bottle.

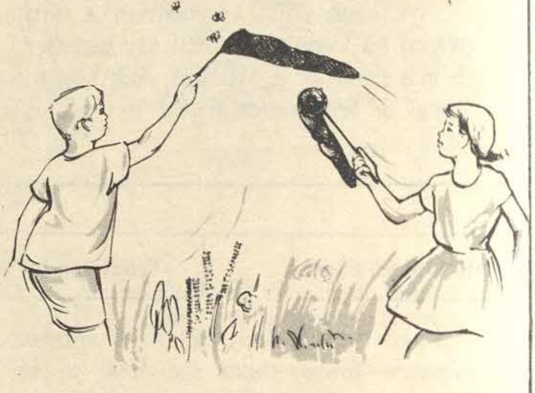


Fig. 9-2
Insects can be collected by using special types of nets.

Investigation

What becomes of the caterpillars found on green plants?

Help the children to collect different kinds of caterpillars found on green plants. Let them put each in a wide-mouthed bottle containing some green leaves of the plant on which the insects were found feeding. A lid with a few holes in it can be used to cover the bottle, or they can use an empty box with holes punched in it and the top covered with cellophane. Let the children observe the caterpillars regularly for a few days. They will be thrilled to see moths and butterflies coming out of them. Ask them to note the number of days it takes for a moth or a butterfly to come out of a caterpillar. See Fig. 9-3.

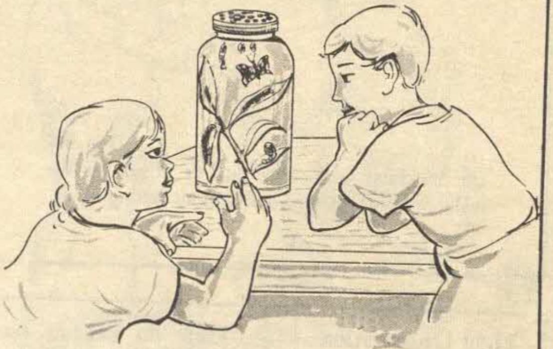


Fig. 9-3
Caterpillars change into moths or butterflies after some days.

Ask the children to collect a sample of stagnant water from a pond or well. Show them the mosquito larvae in this. Transfer them along with the water to a bottle. Let them cover its mouth with a piece of muslin cloth. In how many days do the mosquitoes come out of them ?

For Better Understanding

Insects are small animals. Their body is usually clearly divided into three parts. They have *three pairs of legs*. Many of them have one or two pairs of wings also.

1(d). LIZARDS AND SNAKES ARE FOUND IN HOUSES AND GARDENS

Lizards and snakes belong to a group of animals called reptiles. They become active mostly during the night. Most of these animals prey upon other animals. Lizards are not poisonous. Only a few snakes are poisonous and it is these few that have brought a bad name to the whole group of snakes.

Field Observation

How do lizards catch their prey?

Help the children to observe a lizard in the school building. Show them how it stalks its prey and how quickly it catches the insects. Help the children appreciate the ability of lizards to climb walls or crawl on the roof without falling down. See Fig. 9-4.

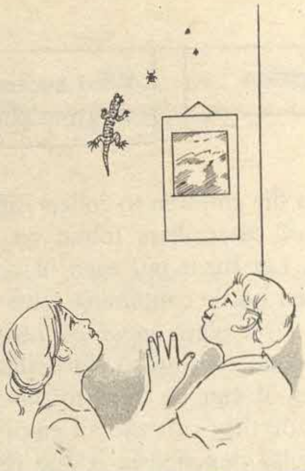


Fig. 9-4
For catching their prey, lizards climb on the walls or crawl on the roof without falling down.

Field Observation

How do snakes move and eat?

Ask a snake charmer to bring a snake and show it to the children. Let them observe its movements and how it eats its food. Encourage the children to feel the snake, and point out to them the way snakes crawl on the floor. Invite some students to try to crawl on the ground like a snake—without using their limbs. They will find they cannot. See Fig. 9-5.

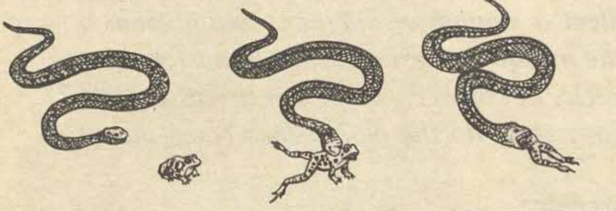


Fig. 9-5
Snakes move by crawling and eat by swallowing.

1(e). FISH AND FROGS LIVE IN AND AROUND WATER

Certain animals live on land. There are others that live only in water. Fish, for example, will die if taken out of water. There are some animals that live both in water and on land. Frogs are example of such animals. Activities such as those given below will help the children to become familiar with the animals which live in or near water.

Class Project

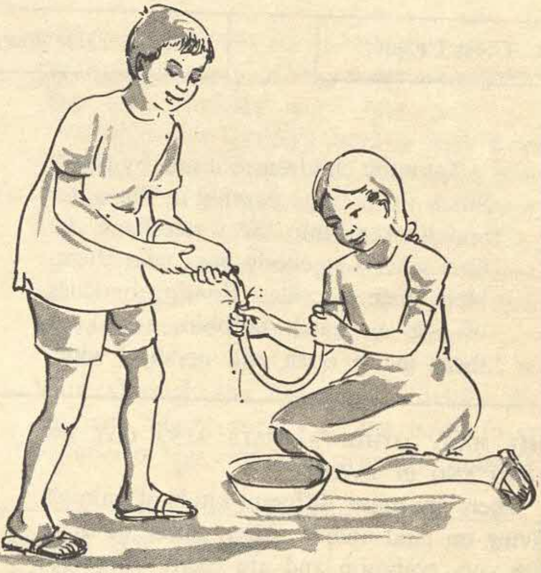
Let us prepare an aquarium

Materials required

- aquarium jar or bottle
- water plants
- fishes
- small scoop nets
- fish food
- earthworms
- paper

Help the children to set up an aquarium in the classroom. Any big wide-mouthed bottle or a battery jar can serve the purpose. First, the aquarium tank should be cleaned well. Then, sand should be repeatedly washed, and then dried. Ask the children to spread the sand inside the tank. Let them plant some aquatic plants in the sand. Help them to fill the tank with water poured over a piece of paper to prevent the sand being disturbed. After allowing the tank to stand in a lighted place for a few days, let the children introduce fishes of different kinds. Warn them to handle them gently. Let them feed the fish regularly once a day and observe their activities. See Fig. 9-6 a-e.

Fig. 9-6 a-e
Let's set up an aquarium tank.



(c) Filling water in a tube to act as a siphon.

(a) Putting and spreading sand at the bottom of the aquarium.

(d) Filling the aquarium tank with water.

(b) Planting aquatic plants.

(e) Releasing fishes in the aquarium.

Class Project

Let us raise some frogs

Materials required
pan or pot
frog eggs or tadpoles
small scoop net

Take the children to a nearby pond. Show them frogs floating in the water and jumping into the water from the land when somebody goes near them. Help them to collect floating bunches of eggs or catch tadpoles and keep them in an open pan or in a wide-mouthed pot half-filled with water. At no time should the vessel get dry. Let them observe the tadpoles growing into adult frogs. Let them understand that water is very essential for the life of frogs.

1(f). MANY OTHER ANIMALS ALSO LIVE ON LAND AND IN WATER

There are many different kinds of animals living on land and in water. Some of them are very common and are easily observed. Some are very useful to man while certain others are harmful to him. Man may not be familiar with all animals. Many animals are brought and kept in zoos. Children always enjoy a visit to a zoo. It is very instructive. If a visit is not possible, the following activity will help the children to know the various kinds of animals.

Field Observation

How can we learn about uncommon animals?

Take the children on a visit to the museum of a nearby secondary school or college. Help them to go round and see the animals. Impress upon the children the fact that there are many kinds of animals living on land and in water. The children know only about a very small number of the animals living on earth. They should be helped to realize how much they do not know.

Collect various books on animals readily available. Gather pictures of animals from old magazines. Show them to the children. Tell them the names of some of the very interesting animals and give a short account of their interesting features. Encourage the children to collect coloured pictures of animals.

2. EACH ANIMAL HAS ITS OWN BODY FEATURES

The children have learnt that animals are of many different kinds. Each kind of animal is recognized by its body features. Cows, for example, have two pairs of legs, a pair of horns and a tail. Horses, too, have four legs, but they do not have horns and their tails are very different from those of the cows. The shapes of the body, head, mouth, legs, etc., differ in these two kinds of animals. Animals of various kinds also differ in size.

When a child sees an animal, he is able to recognize it immediately. He does not sit down to find out the difference in shape and size of the individual organs of the animal. This habit is built up in the child in the course of time. A child seeing an animal for the first time observes its various features and builds up an image of the animal 'as a whole'.

2(a). SOME ANIMALS HAVE FOUR LEGS

Children are already familiar with some domestic animals and pets. They have been aquainted to some extent with the varieties that exist in the animal world. They have been helped to observe the animal life around them. Now they can add to their observations and make use of them.

The children should now be helped to learn through the following activities the external characteristics of the body form, number of legs and other organs of animals.

Discussion **Which of the animals have four legs?**

Encourage each child to name any one animal that has four legs. Put up a list of names on the blackboard. Ask the children to say which animal is big and which one is small. Help them say a few words about the organs of each animal—organs such as horns, the curved tail of a dog, etc.

Show the children the legs of animals like the cow, horse, dog and lizard and point out the differences between these animals.

Exhibit coloured charts or pictures of different animals with four legs in the classroom.

Invite the children for a walk along the roads outside the school. Let them see and tell the names of animals that have four legs. Point out the differences in the nature of the legs of the animals observed.

2(b). BIRDS HAVE TWO LEGS, TWO WINGS, FEATHERS AND A BEAK

Birds are animals with a pair of legs and a pair of wings. The two other important features that distinguish a bird from other animals are its feathers and beak. The following activities will prove useful in distinguishing birds as a group of animals with specific external features.

Demonstration

How does a bird differ from a mammal?

Materials required
a cat or a dog
a chicken or any other bird

Obtain a chicken and a cat or a dog. Ask two children to stand in front of the class. Let one child hold a chicken and another a cat on the table. Help the children to find out the difference in the external features of these two kinds of animals. Let the children touch and feel the animals and find out the nature of the body cover of these two animals. Draw their attention to the beak and wings of the chicken. Ask them to note the difference in the feet of the cat and those of the chicken.

Let the children repeat the activity of contrasting a bird with another animal like a dog. See Fig. 9-7.

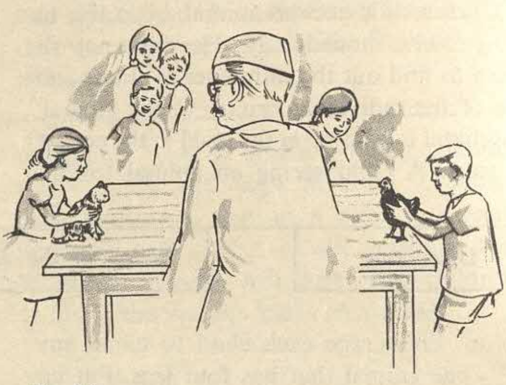


Fig. 9 7
A bird, e.g., chicken, and a mammal, e.g., cat, have many distinguishing external features.

Class Project

What are birds?

Organize a bird show in the classroom. Include in it common birds like chickens, ducks, sparrows, parrots and mynas. Help the children to find the external characteristics that are common to all these different kinds of birds. If live birds are not available, either stuffed birds or pictures can be used.

Class Project

Let us prepare a bird book

Encourage the children to bring pictures of different kinds of birds cut out of magazines. Prepare a 'bird book' for the class.

2(c). INSECTS HAVE SIX LEGS; MANY OF THEM HAVE WINGS

Children are familiar with some insects. The most familiar examples include butterflies, cockroaches, mosquitoes, bees, and flies. The unique feature of insects is their three pairs of legs. Besides these some insects have two pairs of wings also. There are some, like bed bugs, which have no wings.

The following activities will help the children to learn about the body features of insects.

Demonstration

Can we see insects of different kinds?

Show the children the displayed and preserved specimens of butterflies, dragon flies, cockroaches, house-flies and bed bugs. Let them count the number of legs in each case. Let them count the number of wings. Let them observe the presence of six legs in bed bugs, but no wings. See Fig. 9-8.

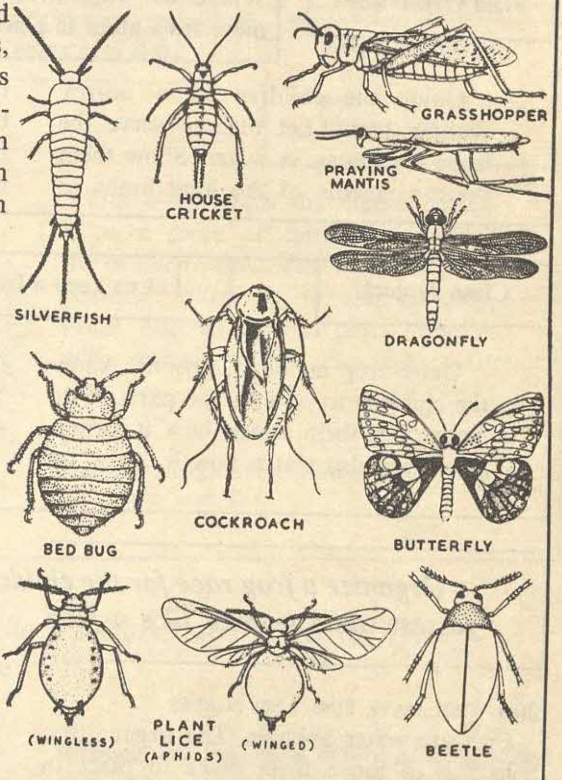


Fig. 9-8
Insects are of different kinds.

Encourage each child to name and describe an insect with which he is familiar. Let him tell where the insect is found, and whether or not it is harmful to people.

2(d). A FROG USES ITS FOUR LEGS FOR JUMPING OR FOR SWIMMING

Frogs live both in water and on land. They have two pairs of legs. The front legs are shorter than the hind ones. The hind legs are webbed. The webbed feet help the frogs to swim in water. When on land, the frogs leap about from one place to another. The hind legs help to give the body a thrust and the frogs leap great distances. The front legs help to support the body when it falls on the ground. Frogs have a smooth moist skin. The following activities may be performed to help the children to learn more about the bodily features of frogs.

Field Observation

Where do frogs live? How do frogs move from place to place?

Guide the children to a nearby shallow pond. Let them observe the frogs swimming in water. Show them the movements of the hind limbs of frogs while swimming in water. Let them observe the frogs leaping in the fields and diving into the water when somebody approaches them.

Class Project

Let us keep a frog in the class

Get a frog in the classroom. Allow the children to observe the parts of its body. Let them watch how it swims. Let them also watch how it leaps on land. Point out its webbed feet and help them to notice its smooth, moist skin.

Organize a frog race for the children of the class. See who can go fastest while leaping like a frog.

2(e). FISH HAVE FINS AND SCALES

Fish are water animals. The organs that help fish to move from place to place in water are the fins. The fins may be of different shapes and sizes in different kinds of fish. Most fish are covered with scales. The following activities will help the children to understand more about fish as a group animals.

Class Project

A classroom aquarium

Materials required
aquarium jar
fishes

Set up a simple aquarium in the class. See sub-concept 1(e) of this unit for instructions. Let the children observe the movements of fish. Draw their attention to the way the fish moves its tail fin to change the direction of its swimming. The two fins on either side of the body help the fish in slow movement. See Fig. 9-9.

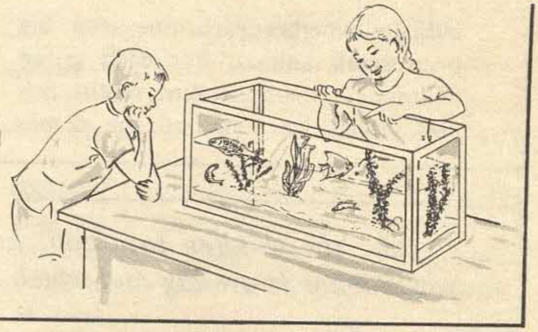
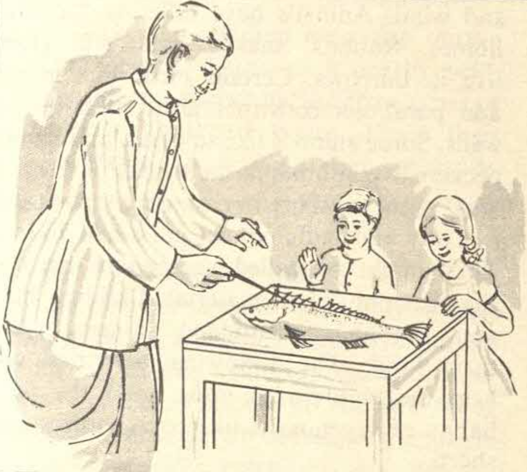


Fig. 9-9
Fish use fins for movement.

Investigation

What are the parts of a fish?

Materials required
fishes
pins
mounted needles



Get a fish from the market. Place it on a piece of cardboard. Stretch its different fins. Pin them to their position. Show it to the children. Point out its various parts—mouth, gills, scales and fins. See Fig. 9-10.

Fig. 9-10
Fish have different body parts like the mouth, gills, scales and fins.

Encourage the children to collect pictures and cards of fishes and prepare a 'fish book' for the class.

2(f). ANIMALS ARE OF MANY DIFFERENT SIZES

Children have already learnt about many varieties of animals. They can be helped through the following activities to recollect that some animals are big and some are small.

Discussion

How can we group animals according to size?

Ask the children to tell the names of animals they know. Ask them to indicate whether each one is a big or a small animal. For each group of animals—mammal, bird, reptile, fish and insect—let them tell the names of big and small animals with which they are familiar. Count the number of big and small animals familiar to the children.

Take the children to a zoo. Let them find out for themselves which animals are big and which are small.

3. ALL ANIMALS REQUIRE FOOD AND SHELTER

Animals are living organisms. Just as people want food when they are hungry, so do all other living organisms. Some animals like chickens, sparrows, crows eat all through the day. Certain animals like snakes can manage without food for several weeks. Different kinds of animals eat different kinds of food. Some like cows, buffaloes, horses and sheep eat only grass or leaves. Animals like the dog, cat, lion, and tiger eat the flesh of other animals. Others like crows, chickens and rats eat materials of many different kinds.

In addition to food, animals need a place to protect themselves from heat, cold, rain and wind. Animals have different types of homes. Rabbits, snakes, rats, and crabs live in burrows. Certain birds like mynas and parakeets construct nests in holes on walls. Some animals like squirrels and woodpeckers live in holes in the trunks of trees.

3(a). SOME ANIMALS EAT GRASS AND FODDER

Cows and buffaloes eat grass and fodder. They might be called vegetarians because they eat only plant material. Children have seen the above-mentioned animals eating their food. The following activities will help the children to understand the food habits of vegetarians like cows, horses and sheep.

Discussion

Which animals eat only plants?

Ask the children to mention the various items of food that are eaten by cows and buffaloes. Let the children mention the names of other animals (camels, sheep, and horses) that eat grass and fodder.

Field Observation

What are the feeding habits of cows, buffaloes and horses?

Encourage the children to watch the various items of food given to cows, buffaloes and horses in a farm. Help them feed grass to either a cow or a sheep or a buffalo. Let them observe how these animals grind the food and swallow it.

3(b). SOME ANIMALS EAT GRAINS

Animals like sparrows and pigeons mainly eat grains. There are certain other animals that eat grains when they can. When grain is not available, they depend on other food materials. Such animals include rats, squirrels, mice, crows, hens, etc. The following activities will widen the children's knowledge of the animals that depend on grains as food.

Field Observation

Which animals eat grains?

Take the children on a trip during the harvest season to a nearby field. Let them observe the different types of animals that eat grains. Draw their attention to animals like sparrows and pigeons eating only grains. Point out that animals like hens and crows eat grains, but they also chase and snap up certain other animals like insects, lizards and young calotes for food.

3(c). SOME ANIMALS EAT INSECTS

A number of animals eat only insects for their food. The most familiar examples are frogs, lizards, calotes, spiders, scorpions, etc. Since insects are mostly flying animals, the animals which feed on them have certain devices for catching them. Spiders spin a web to catch insects. The prey is captured when a spider winds thread round its body. Frogs have long sticky tongues. The tongue is shot out and folded back into the mouth with the prey. A lizard stalks its prey carefully, then takes it in a fraction of a second. The tongue of a lizard is much like that of a frog. Birds fly after insects and catch them.

These devices for catching insects will be appreciated by children through the following activities.

Field Observation

How do spiders catch their prey?

Help the children observe a spider's web with a spider in its centre. Point out the nature of the web. Some webs consist of strands radiating like the spokes of a wheel and fastened by spiral connecting threads.

Encourage the children to take any small insect like a termite or an ant or a small caterpillar and drop it on a spider's web. Let the children see the insect getting stuck to the web. Let them also observe how the victim is tied by the spider's threads. See Fig. 9-11.

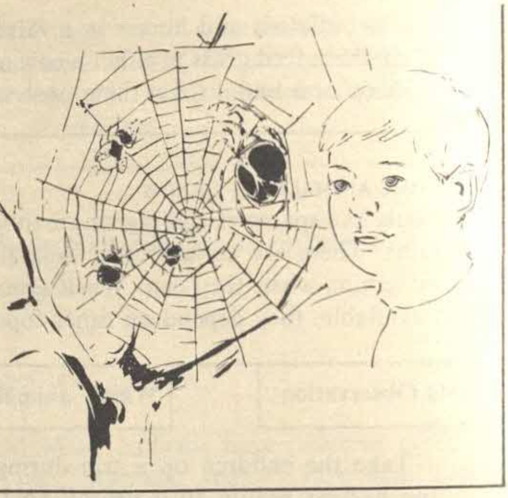


Fig. 9-11
Spiders spin webs to catch their prey.

Help the children to see the way frogs catch insects. This can be easily observed on rainy days and near the lamp posts at night. Encourage the children to observe lizards capturing their prey. Help them to observe a calote catching an insect.

3(d). SOME ANIMALS EAT OTHER ANIMALS

The children have learnt that certain animals eat insects which are also animals. There are animals which eat the flesh of other animals. Snakes eat rats, frogs, rabbits, etc. Jackals, foxes, tigers and lions kill other animals and eat them.

Children can be helped to learn this sub-concept better through the following activities.

Discussion

What are some of the flesh-eating animals of the forest?

Collect pictures of wild animals like lions, tigers, foxes, jackals, hyaenas, wolves, and pythons. Acquaint the children with the names of these animals. Tell the children stories about these animals hunting and killing other animals for their food.

Take the children to a nearby zoo or circus during the feeding time of the animals. Let them see these animals. Help them to ob-

serve the food given to these animals and how they feed on it.

Help the children to observe how cats kill and eat rats.

3(e). ALL ANIMALS REQUIRE SHELTER FROM SUN, COLD, RAIN AND ENEMIES

Animals cannot bear extreme heat or cold. If exposed to such extremes, they die. However, they protect themselves against heat or cold by taking shelter in certain places. Here are some activities which can help children to appreciate the great variety of shelters used by animals.

Investigation | **Where do animals disappear when it is very hot or rainy?**

Show the children the presence of a large number of animals in summer in the early morning hours and in the late evenings. Discuss with the children where these animals stay during the day. When it is too hot the children can be shown the animals taking shelter in houses or in the shadow of trees. This can be seen in the neighbourhood of the school. Help the children to observe that small animals are not seen when it rains, or during the cold, winter days,

Point out that while many animals find their own shelter, some are provided with it by their owners. This is the case with many pets and farm animals.

3(f). BIRDS MAKE NESTS

Children have learnt that animals require shelter against heat, cold, wind and enemies. Usually they spend their time inside their shelters when there is excessive heat or cold or storm or when threatened by enemies. The homes of animals may be of different types. Among the animals, birds have special types of homes. Their homes are called *nests*. Nests are built in different places. Sparrows build their nests inside the house, in crevices and holes in the walls. Crows and eagles build their nests on tall trees. Mynas and parrots build their nests in the holes of trees or in any convenient hedge or corner. Certain water birds, like seagulls, make their nests and allow them to float on water.

The children will be helped to get a better understanding of this sub-concept through these activities.

Field Observation **What material is used in the nests of birds?**

Show the children the common nests of sparrows constructed inside schools and houses. Select an old nest to show the various materials that are used in making it—bits of dried twigs, grass, bits of paper, cotton, etc.

Find some birds making nests and help the children watch the process.

Scientists at Work **Some scientists study animals**

Even before entering school, you were familiar with some animals. You could recognize them. You also knew something about their way of life. For example, you knew what food they eat, how they eat, how they move from one place to another, how they tend their young ones, etc.

You have come to know of animals mainly in the following ways. You personally saw some animals and observed their way of life. Somebody told you about some other animals. You saw pictures of animals in books and your mother or father or sister told you about those animals. But still you know about a very small number of animals. There are a large number of animals living on the earth today. They are of many different kinds.

If you observe these animals in nature and learn about them, all your life, you can learn only about a few hundred animals. These few hundred animals are nothing compared with the large number of animals which exist. More and more new animals are being discovered in seas, rivers, forests and on mountains. How do people know the names and life of large animals found on this earth? People who have studied these animals have written large volumes of books about them. Who are these people who discover animals and write books about them? They are *scientists*. There are many kinds of scientists. Some work with rocks, some with plants, some with animals, some with chemical substances, some with machines, etc.

How do scientists come to know of new animals? They go in search of animals. Such a search is called an *expedition.* They go on expeditions into the seas, to mountains, forests, caves, etc. They collect much new information about animals. They catch and keep certain animals in zoos or laboratories, observe them periodically and conduct experiments on them. They read a great deal about their work in books.

Charles Darwin was one such scientist. He was an Englishman who lived about one hundred years ago. He went out on expeditions, collected and observed various kinds of animals. He drew certain important conclusions about the way in which various kinds of animals we see today came into existence on this earth. You will study more about his conclusions in higher classes.

Even during his boyhood he showed the qualities of a scientist. He was greatly interested in observing and collecting animals and other materials. When in school, he collected beetles, butterflies, minerals and eggs of birds and preserved them. He was not a ruthless collector and killer of animals. His sister told him to be kind to animals. Therefore, he used to collect mostly dead butterflies. He would pick up only one egg from a bird's nest.

One of the features of a scientist is that he is curious. He wonders why things are as they are and how they came to be this way. Because scientists are very curious, they try to find answers to their questions and explanations for what they observe. To do this they observe and they experiment, they study and they think. Although it is hard work, scientists thoroughly enjoy what they do. They think the 'work' of a scientist is 'fun'.

Are you curious? Do you ask many questions? Do you like to find out things for yourself? If so, you like doing what scientists do. You are really a child-scientist at work!

UNIT 9

ANIMAL LIFE

CLASS II

Overview

In class I children began to organize into knowledge the bits of information about animals which they already had. They learnt that animals of different kinds abound in their environment. But how are children affected by these animals? Each child has some kind of experience or the other with animals. For example, ants may have bitten a child or a crow or an eagle might have snatched away his food. A dog might have barked at him. Thus different kinds of animals would have produced mixed feelings. This is the time to introduce him to the useful role of some animals—animals as friends of man. At this class level there is a quick survey of some domestic animals and their uses to man.

Having learnt something about the domestic animals, children will wish to know about their relationship to the other animals they see in their environment. There can be no better opportunity than this to guide them into nature and help them to understand the life of wild animals. The domestic animals of today once lived as wild animals. Man selected and domesticated only those animals which he found very useful.

Man provides the domestic animals with the basic necessities of life—food and shelter. The children are familiar with this. The children are also curious to know on what food the wild animals live and where they take shelter. Here again the children can be guided to gain knowledge through observation. The type of observation that will help the children will be slightly different from that adopted by them in class I. It will be a more challenging and a more prolonged observation. It will have to be repeated a few times before conclusions are drawn.

In class I, the children were helped to observe the food habits of certain specific animals, for example, grain as the food of some animals, grass and fodder as the food of some other animals, insects as the food of certain other animals. In this class the children are required to draw certain generalizations from their observations. They are guided to group animals as plant eaters, animal eaters, mixed feeders and so on.

1. DOMESTIC ANIMALS SERVE MAN IN MANY WAYS

Some animals are kept by man for various uses. These animals are called domestic animals. Many of the domestic animals are mammals. They provide milk and meat.

Their skin and wool are useful for clothing. They help man in hunting and tilling the land. They carry people and their belongings from one place to another. They are helpful in guarding man's property and in keeping down the number of certain pests like rats and mice. They also serve as constant companions and friends to man. These domestic animals include dogs, cats, sheep, goats, oxen, cows, buffaloes, horses, pigs, donkeys and camels. The sub-concepts which follow are planned to help the children to learn more about domestic animals.

1(a). SOME DOMESTIC ANIMALS PROVIDE MILK TO MAN

Some animals give milk to their young ones. All such animals belong to the group known as mammals. Milk is thus an animal product. Milk provides a very well-balanced, nourishing food. It is available to man from cows, buffaloes, goats and a few other animals too. The following activities will help the children to know more about the milk-giving animals and milk.

Discussion **What animals provide milk for man?**

Ask the children to tell the names of animals from which the milk they drink is obtained. Recall the various kinds of animals that give milk to their young ones. Discuss that man obtains milk only from certain animals like cows, buffaloes and goats.

Help the children to visit a farm-house in a village to see how milk is obtained from a cow, buffalo, or goat.

Discuss with the children the different types of milk products they eat.

1(b). BIRDS SUPPLY MAN WITH EGGS

Eggs are often used as food. Most children know that eggs are laid by female birds. Hens and ducks lay eggs and they are birds. Unlike other birds, domestic hens and ducks lay eggs all through the year, and also lay a large number of them. These eggs are bigger than the eggs of many other birds. Therefore, man rears these birds to get a supply of eggs regularly.

Discussion **Which of the animals provide most of our eggs?**

Ask the children to mention the names of animals that lay eggs and which are used as food by man. Encourage the children to find out from their parents or neighbours the number of eggs a hen or a duck lays in a month. Discuss their findings in the class next day.

Field Observation

What can we see at a poultry farm?

Take the children to visit either a poultry farm or the poultry yard of a village home. Let the children see the eggs obtained from the fowls. Help them to recognize the different types of hens kept there. Let them find out which kind lays the largest number of eggs in a month. Let a person from the poultry farm explain to them how the eggs are incubated and chickens hatched. Let the children get a chance to see the young chickens coming out of the eggs.

Show the children the eggs of certain local birds. Tell them about the number of eggs laid by these birds in a season. Help them compare the number and size of eggs of hens and ducks with those of other birds. Discuss the reason for men having domesticated some fowls.

For Better Understanding

It is possible to obtain eggs without any living embryo inside. The eggs without any living embryos are *unfertilized* eggs. Even if the cocks are kept away from the hens, the latter lay eggs. Such eggs are all unfertilized eggs.

After a cock mates with a hen, the microscopic sperms are released. A sperm gets into an egg before the shell is formed. The sperm unites with a part called *ovum* while the egg is still inside the female bird. The union of the sperm and ovum is called fertilization. The young embryo develops as a result of fertilization into a baby chick. Whether the sperm enters the body of the hen or not, an egg gets fully formed. It does not wait for the entry of the sperm. In such eggs, the yolk is present, but there is no embryo—such an egg can never hatch into a baby chick. The yolk is a highly nutritious food. It is an animal product like milk. The white of the egg is also nutritious.

1(c). WOOL IS OBTAINED FROM ANIMALS

Woollen materials are used for making clothes. Woollen clothes keep the body warm during winter. Woollen materials are made from wool. Wool is the hair which covers the body of the sheep. It is obtained only from certain varieties of sheep. The following activities will be useful in helping the children to understand the importance of sheep in contributing wool.

Demonstration **What materials are made from wool?**

Collect different types of woollen materials locally available. Show them to the children. (If it is not possible to bring the materials to the classroom take the children to the place where materials are available.)

Field Observation **How is wool processed?**

Take the children to a nearby place where wool is removed from sheep and processed. Show them the various steps. If this is not possible, show the children pictures depicting the various steps of processing wool, of spinning yarn and of weaving woollen materials.

For Better Understanding

Sheep are of different kinds. Some yield good milk, some meat, and others wool. Some kinds of Indian sheep are the world's best producers of superior wool for carpets. Rajasthan, Maharashtra, and Gujarat produce the major portion of Indian wool.

Wool protects sheep from heat and cold and keeps them in a healthy state. Removal of wool at certain times of the year is not healthy for the sheep. Shearing or cutting of wool is not done when the weather is too hot, or rainy, or very windy. The end of winter, when the weather is warm, is ideal for the shearing or cutting of wool. The sheep will not need it for many months. The sheared wool is cleaned and bleached. It is then carded and spun into yarn. Woollens are made from the yarn.

1(d). CERTAIN DOMESTIC ANIMALS ARE USEFUL AS DRAUGHT AND FARM ANIMALS

Oxen, horses, camels, buffaloes, donkeys and mules are some domestic animals. These are useful for carrying loads from place to place. The oxen and horses are used for dragging carts or carrying people from one place to another. Camels can carry people over long distances through a desert. Donkeys, mules and camels are also useful for carrying loads. Buffaloes, oxen and camels are also used in certain agricultural operations. They draw water from the wells for irrigating lands. They plough the soil. They tread on the harvest and separate the grain from the straw.

The teacher can help the children appreciate the various uses of draught and farm animals through activities of the following type.

Discussion **What role do draught animals play in our lives?**

Ask the children to mention the names of some animals used for transporting people. Let them say which animals serve to pull carts. Let them also tell which animals are used for carrying people and loads directly on their backs. Let them identify these animals in pictures.

Discussion **What are the common farm animals? How are they useful?**

Discuss with the children the uses of some animals in farming. Let the children describe in a few words some of the agricultural operations for which animals are used. Show the children pictures of these operations

Arrange a trip to a nearby field to show the children the various farm operations in which animals help.

1(e). SOME ANIMALS GUARD OUR HOMES AND FIELDS

Children know that dogs keep a watch over houses. They bark and alert the members of the family when strangers approach the house. Thieves are afraid to enter the houses which have dogs. Dogs keep a watch over the crops, farm animals and implements in the fields.

Rats and mice are found in houses, shops and godowns. They consume the grains, cause damage to the clothes, gunny bags, beddings and other things. Therefore, rats are man's enemies. Cats help man by killing rats and mice.

The children can be helped to appreciate the usefulness of dogs and cats through the following activities.

Discussion **How do dogs help man?**

Find out how many children have dogs as their pets at home. Encourage them to say in which way dogs are useful to them. Discuss with them the instances in which the dogs were responsible for either catching or scaring away thieves. The information could be obtained by the children from their parents and neighbours.

Discussion | **How are cats useful to man?**

Encourage the children to enumerate the various kinds of damage caused by the rats and mice in their homes. Find out the number of children in the class who have cats as pets. Discuss whether the rat menace was reduced after cats were taken as pets in their houses.

Encourage the children to collect stories of dogs that served their masters faithfully. Let the children narrate these to the class.

Let the children visit either a grain shop or a godown and find out the damage caused by rats and mice. Discuss this in the classroom.

1(f). THE MEAT OF CERTAIN ANIMALS IS COOKED AS FOOD

Children have learnt that domestic animals are useful to man through their products and work. Some animals like sheep, goats, pigs, fowls and pigeons are reared to serve as food for man.

Help the children to understand that meat obtained from certain animals is useful to some people as food, through the following activities.

Discussion | **How is meat obtained?**

Find out how many children in the class eat meat. Ask them how they get the meat they eat. Let them tell the names of various animals that are reared and killed for meat.

Field Observation | **What are the various products of meat?**

Encourage the children to visit a nearby meat shop and find out the various food products obtained from the meat of animals. Let them also see canned and tinned meat and fresh products.

Visit a nearby meat processing factory, if there is one. Let the children observe how the various meat products are processed and sent for sale.

1(g). THE SKINS OF SOME ANIMALS ARE USEFUL FOR LEATHER

Besides meat and other parts of animals, the skin is also used by man. Leather is obtained from animals. Shoes, bags, leather jackets, suitcases and gloves are often made of leather. These articles are made from the skins and hides of cows, buffaloes, horses, goats and pigs. After the animals are dead, the skin is removed. During the tanning process the skins are treated with chemicals and produced as leather.

These activities will help the children to understand the usefulness of the skin of certain animals in producing leather.

Discussion

What are the various products made from leather?

Let the children name the different articles that are made of leather. Let them name the various animals from which leather is obtained. Discuss with them how leather is made from the skin of animals.

Arrange a visit to a leather tanning factory, if possible. Let the children see how the skins of animals are processed as leather.

Arrange a visit to a leather goods shop. Let the children find out from which animals the products of leather sold in the shop are obtained. See Fig. 9-12.

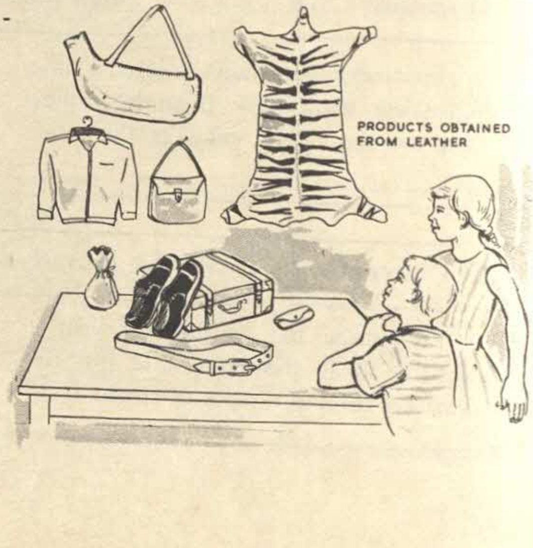


Fig. 9-12
The skin of animals is used for preparing various kinds of leather goods.

For Better Understanding

Leather is made from hides or skins. After the hide is dried and disinfected by treatment with chemicals, it is placed in vats of caustic soda, which removes the hair from the skin. Then the hide is washed in clean water and treated in a solution of tannin. After it is soaked in tannin for weeks, the hide is taken out, washed and dipped in a solution of chromic acid. This makes the hide tough and gives it a brown colour. After this the hide may be beaten into uniform thickness before being cut into useful pieces.

1(h). THE DUNG OF ANIMALS IS A GOOD MANURE

Some animals are useful because they provide meat, eggs and leather. Their dung is also useful. It is used as a manure. The droppings of animals enrich the soil. The plants grown in the soil containing manure yield better produce than the plants grown in soil without any manure. The teacher can help the children to realize the usefulness of dung of animals as manure through the following activities.

Discussion

How is animal dung useful?

Find out how many pupils have parents who own fields or who work in fields. Ask them to tell which animals' dung is useful as manure for plants. Encourage them to say how the dung is collected and applied to the fields.

Investigation

How does cowdung affect the growth of plants?

Help the children to select two potted plants. One should be grown in a soil which contains decayed dung, and the other without it. Help the children to compare the growth of these two plants. See Fig. 9-13.

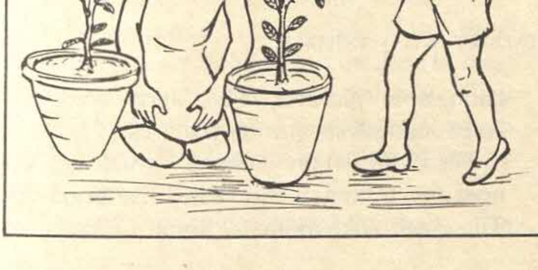


Fig. 9-13
Decayed dung helps the plant to grow better.

Invite a gardener to talk to the children. Let him state the various means by which he enriches the soil.

1(i). DUNG SHOULD NOT BE USED AS FUEL

In villages and towns, cowdung is made into fuel cakes. After it is dried it is used as fuel. The dung is thus unavailable for use as manure. The manure when used in fields yields more paddy, wheat, vegetables, etc. The dung used as manure provides more food materials.

The children can be helped to realize through the following activities that cowdung is more fruitful when used as manure than as fuel.

Discussion | **How is cowdung wasted as fuel?**

Find out from the children whether they are aware that dung is used as fuel. Let them describe how dung is converted into fuel. Discuss with them how the valuable dung is wasted when it is used as fuel. If dung is used as manure it results in higher yield from plants in fields. More yield means more food for man.

Encourage the children to go round the village after school hours and observe the vast quantities of dung being converted into fuel.

For Better Understanding

Ways are now being developed for using dung both for fuel and for manure. The dung can be heated under special conditions and provide a useful gas and also useful ashes. The resulting gas can be used as fuel, and the ashes can be used as manure-type fertilizer. A farm with 20 or 30 animals could with very little expense set up such a dung gas plant, and thus get the maximum value from the dung. This is a good example of applying modern science to the age-old problems of keeping warm and still having high-yield crops.

2. THERE ARE MANY KINDS OF WILD ANIMALS

In class I children have learnt that there are different kinds of animals around them. They are familiar with various domestic animals and pets. They have heard about many more animals. They have seen some animals in pictures. They have also seen some animals in motion pictures.

There are many animals which do not need much human care. They live in nature. These are wild animals. Some of them are very large and some are quite small. Wild animals are far more numerous than domestic animals. Wild animals are of many different kinds.

2(a). BIRDS, REPTILES AND OTHER ANIMALS MAY BE WILD

Elephants, lions, tigers and wolves are some examples of wild animals. These are mammals. Eagles, vultures, cranes, and owls are also wild animals. These are birds. Snakes crocodiles and calotes are examples of wild reptiles. Butterflies, ants, termites are wild animals in the sense that they are free in nature. These are insects. Thus the wild animals are not confined to any single group. They belong to many different groups.

The children will be able to understand the different kinds of wild animals in a better way if the following activities are performed.

Class Project

Can we organize wild animals into groups?

Ask the children to bring pictures of any animal. Let them get these pictures from old magazines, newspapers or old books. Help them to sort out the pictures of wild animals, and to group them as mammals, birds, reptiles, fishes and insects.

Arrange an excursion to a zoo, if there is one nearby. Encourage the children to observe the names of as many wild animals as they can. Encourage them to arrange the animals in groups. Praise the children who have noted the names of the maximum number of animals.

For Better Understanding

Mammals are warm-blooded animals. The temperature of the surroundings changes very widely according to the seasons and also during day and night. Warm-blooded animals keep their body temperature constant. Mammals give birth directly to the young ones. The young ones suckle milk from their mothers. Mammals have hair on their bodies.

The birds are a group of animals. They are also warm-blooded. They possess feathers and a beak. The fore-limbs are modified as wings. They lay eggs.

Reptiles are cold-blooded animals. The body temperature in these animals is not constant. It changes according to the temperature of the surroundings. Reptiles are crawling animals. They have either scales or shields on them. Examples of reptiles are lizards, calotes, snakes, turtles and crocodiles. Unlike mammals, reptiles lay eggs.

Insects are small animals without backbones. They have three pairs of legs. Many insects possess one or two pairs of wings and can fly. The body of insects is divided into three parts. Bees, butterflies, mosquitoes, bed bugs, beetles, wasps are examples of insects.

2(b). SOME WILD ANIMALS ARE HUGE

Children are familiar with the fact that the animals are of different sizes. Elephants are wild animals. They are tamed by man for being kept in zoos and temples or for work in forests, or for performance in a circus. Tamed elephants are useful for felling trees and dragging logs of wood in forests. Elephants are kept in certain temples to be used during festivals.

The following activity will enable the children to know more about elephants as animals huge in size.

Discussion **What are elephants like?**

Discuss with the children the life of elephants in forests. Help the children to describe the different organs of an elephant. Make use of a picture or wall chart. Tell them stories about elephants.

For Better Understanding

Elephants eat leaves and parts of plants in the forests. They live in herds (groups). They frequently come to the river to drink water and to bathe. Elephants can easily uproot and pull out trees. Elephants are mammals. Elephants give birth to their young ones. A newly born elephant weighs about 75-100 kilograms. Sometimes elephants become mad. They are called rogue elephants. Rogue elephants destroy trees, crops and enter into villages and kill people.

2(c). SOME WILD ANIMALS ARE VERY SMALL

Wild animals are of different sizes. Rabbits and squirrels are small. Vultures and eagles are fairly large birds. There are small wild birds like king-fishers and woodpeckers. A large number of insects and reptiles are examples of small wild animals.

Through the following activities the teacher can help the children realize the existence of wild animals that are smaller in size than those studied so far.

Class Project **How can we classify animals according to size?**

Make use of the pictures of wild animals collected by children. Help them to state which are big and which are small animals. Classify them. Count and find out how many among the wild animals known to the children are big and how many are small.

Encourage the children to prepare two picture albums : one entitled 'Small Wild Animals' and another 'Big Wild Animals'.

Take the children to the museum of a nearby secondary school or college. Let them appreciate the fact that there are numerous small wild animals in this world that they have not seen so far.

2(d). MAN DOMESTICATES ONLY THOSE ANIMALS THAT ARE USEFUL TO HIM

Children have learnt that there are many wild animals. Some of them are big and some are small. Some of them live in forests. Others live near cities, towns and villages. Man has domesticated some animals that are useful to him in some way or the other. Compared to the many kinds of wild animals, there are very few kinds of domesticated ones.

The following activities will be useful to help the children realize that man has domesticated only those animals that are useful to him.

Discussion

How many wild and domestic animals do we know?

Ask the children to collect pictures of various animals, both wild and domesticated. Help the children to sort out the animals into groups—wild and domesticated ones. Paste the pictures of the wild animals on one cardboard and the domestic animals on another. Ask the children to identify the various wild animals. Discuss with the children the names of various domestic animals and their uses to man. Help the children to realize that man domesticates only those animals that are useful to him.

3. SOME WILD ANIMALS MAKE THEIR OWN HOMES

Man builds homes for himself to live in. He also builds shelter for the animals he has domesticated for his own use—cow sheds for cows and stables for horses. Sheep are sheltered in pens and birds in cages.

Some wild animals also require shelters to live in. They make their own homes in their natural surroundings. Lions and tigers, for example, live in caves or in thickets in the forest. Certain animals either dig holes for living or live in holes already dug by other animals. The following sub-concepts provide some of the details of this general idea.

3(a). MANY WILD ANIMALS DEPEND UPON NATURAL SHELTERS FOR THEIR HOMES

Many wild animals make use of natural surroundings as homes. Elephants live in herds under the trees of the thick forest. Lions and bears live in caves. Tigers often live hidden among thick bushes in the jungle.

The following activities will enable the children to understand how natural shelters are utilized by many wild animals as their homes.

Field Observation

What are some natural shelters of wild animals ?

Take the children to some nearby uncultivated land with plenty of plant growth. Show them the thick bushy growths. Point out the presence of small animals like calotes, partridges, rats, etc. Let the children see the small animals hiding underneath big stones or rocks. Show them tortoises hiding themselves among the fallen leaves. Discuss with the children that in forests the thick plant growth offers protection to many kinds of animals.

Encourage the children to collect information about the use of natural surroundings by wild animals. They can gather this information from their relatives or neighbours who have some acquaintance with wild animals in the forests. Let them narrate this in the class.

Develop dramatic play activities, Let the children imitate different animals. Let each one individually come before the class and say how he leads 'his own animal life' in the forest.

3(b). BIRDS BUILD THEIR NESTS IN TREES OR PROTECTED PLACES

Birds build nests where they lay eggs, hatch young ones and protect them till they are able to fly. They build their nests on trees or in places where they will be safe with their young ones. Vultures and kites build their nests either on tree tops or on the tops of rocks on hills. Owls build their nests in the hollows of trees. Mynas and parrots build nests either in the crevices of walls of buildings or in the holes of trees.

The children can be helped to develop interest in observing the nests and nesting habits of birds through activities such as the following.

Discussion

How are nests useful to birds?

Give each child an opportunity to say a few words about the nest of a bird he has observed. Show them pictures of the nests of different birds. Discuss with children how nests are useful to birds.

Arrange a show of the various types of birds' nests which have been collected and preserved by the children.

3(c). MANY ANIMALS DIG HOLES IN THE GROUND TO LIVE IN

Children, as they walk along the fields, or while visiting the sea-shore, may have noticed a large number of holes. In these holes one might very often find either crabs, or rats, or mice, or moles. These holes are dug by these animals. They serve to protect them from their enemies.

The children will be able to understand better the homes of the animals through activities such as the following.

Discussion **Which animals live in holes?**

Let the children recollect the names of animals that they have seen in the holes found in the fields. Discuss with them the use of these holes to these animals.

Take the children to a museum. Let them see the burrows of different types of burrowing animals. The burrows, with the channels and the animals inside, are exhibited in the museum.

Help the children to collect pictures of burrows of animals from newspapers, magazines and books.

3(d). SOME ANIMALS LIVE IN HOLES DUG BY OTHER ANIMALS

The children have learnt that certain animals like rats, mice, and moles live in holes. These are dug by the animals which occupy them. Snakes and rabbits also live in holes. But these holes have been dug by other animals, that is, they occupy the homes of some other animals.

The following activities can be undertaken to help the children to learn about this sub-concept.

Discussion | **Where do snakes live?**

Discuss with the children the places where snakes live. Let the children recall the presence of holes in the termite hills. Help them to find out that these hills are hollow inside and are built up by the tiny termites. Let them also learn that deadly poisonous snakes are sometimes found in the holes of these termite hills. Help them to realize that a number of different kinds of snakes occupy the holes dug by other animals. See Fig.9-14.

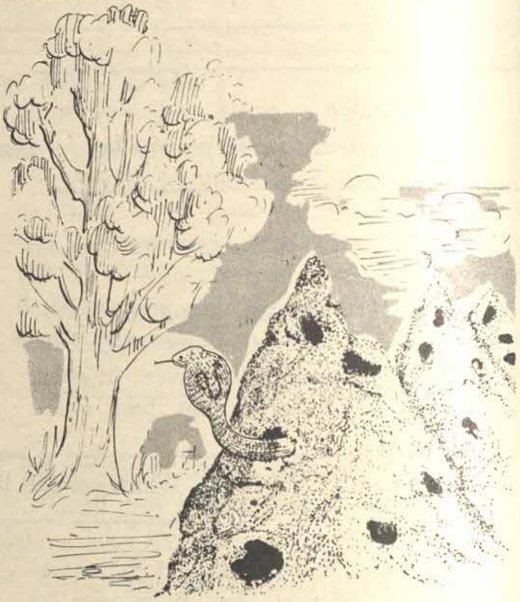


Fig. 9-14
A snake lives inside the termite hills or in holes dug by some other animals. It is dangerous to play with such holes in the ground.

Show the children either the termite hills in the fields or pictures of them. Point out the holes in them. Let them understand that these are sometimes occupied by snakes.

4. THE FOOD HABITS OF WILD ANIMALS DIFFER

Children have seen that domesticated animals need food. Wild animals also need food to live. Some of the wild animals eat grass and leaves and other parts of plants. Certain animals can eat only the flesh of other animals. There are animals capable of eating both plant material and the flesh of other animals. Some of the details of this general idea are brought out in the sub-concepts that follow.

4(a). SOME WILD ANIMALS EAT ONLY PLANTS

A number of domestic animals like cattle, sheep and horses eat only parts of plants. This habit of eating plants is prevalent in many wild animals also. Elephants, deer, and rabbits, for example, eat certain parts of plants like leaves, stem, bark and roots. Plant-eating animals are known as *herbivorous* animals.

The teacher can help the children to understand this sub-concept by undertaking the following activities.

Discussion | **Which plants are food for wild animals?**

Ask the children to mention the various parts of plants that serve as the food of animals. Discuss with children as to which of these form food items for wild animals.

Arrange a trip to the zoo, if there is one nearby. Let the children observe the various plant-eating wild animals during their feeding time. Help them to realize that there are many herbivorous animals that they have not seen before.

For Better Understanding

Plants are a source of food for all animals, wild and domestic. Without plants, all animals—including man—would soon perish. Some animals feed directly on plants.

4(b). SOME WILD ANIMALS EAT ANIMAL FLESH

Children have learnt that some wild animals eat plants only. There are some wild animals that live directly on other animals. Such wild animals kill the smaller or weaker animals for their food. Lions, tigers and leopards kill other animals like deer and goats. Sometimes they attack man also. Snakes eat rats and frogs. Birds eat insects and worms. Hawks and owls eat rats and small birds like pigeons and chickens. Flesh-eating animals are called *carnivorous* animals.

The teacher can help the children know about the food habits of flesh-eating animals through the following activities.

Observation | **Which of the animals eat other animals?**

Ask each child to go for a long walk and observe the small wild animals in the vicinity of his house. Let them find out what these animals eat. Discuss with them in the class what they have observed regarding the animals that eat other animals. Frogs eat worms and insects; birds eat calotes, frogs, rats, etc.; wild cats and mongooses eat birds, etc.

Discussion

How do many wild animals hunt other weaker animals?

Collect coloured pictures of big flesh-eating wild animals like lions, tigers, leopards and wolves. Help children understand through pictures how these animals hunt other animals and eat them. Tell them some instances of tigers attacking man for food.

Encourage the children to observe wild animals like lions, tigers, leopards and wolves in either a circus or a zoo, and notice how they eat the flesh of other animals.

Help the children to collect pictures of animals that eat other animals. Match the pictures of animals and those of their prey on separate sheets of paper and prepare a booklet.

4(c). SOME ANIMALS EAT BOTH ANIMALS AND PLANTS

Some wild animals are not particular about the food they eat. They can accept a wide range of food items of plants and animal origin. Children have seen crows eating all sorts of food materials. Rats can eat insects, meat, grains, bread, etc. Bears are big wild animals living in jungles. They eat honey, roots of plants and flesh of other animals including fish.

The animals that eat plants and flesh of other animals are called *omnivorous* animals. Omnivorous animals eat many types of food. Men in general belong to this group.

The teacher can help the children to realize that some wild animals are capable of eating both animals and plants, by undertaking the following activities.

Field Observation

On what food do crows feed?

Leave small amounts of leftovers like rice, chapati, meat, fish, *dal*, etc., in the open yard of the school. Let the children observe the crows eating away these types of food materials. Ask the children to draw conclusions about the food habits of crows.

Encourage the children to collect pictures of animals that eat both plants and animals. Let them paste these pictures in a notebook. Help them to write the names of various items of food materials eaten by each kind of animal in the space adjoining the picture of the animal.

4(a). SOME WILD ANIMALS EAT THE REMAINS OF DEAD ANIMALS

Wild animals like lions, tigers, and leopards chase their prey, kill it and eat the flesh while it is still fresh. Sometimes these animals leave some portions of the hunt uneaten. The remains of these dead animals are usually eaten by foxes, jackals and vultures. These animals help to dispose of the dead bodies of other animals. Thus they act as scavengers.

Help the children to understand this idea through the following activities.

Discussion **What is the food of vultures?**

Let the children who have seen vultures eating dead animals tell the whole class what they have seen. Discuss with the children how vultures in large numbers feed on the dead bodies of animals. Help the children to know the habits of some more animals like jackals that eat dead animals.

Scientists at Work **Early man learned to domesticate animals**

Early man lived in caves. He collected fruits and vegetables for food. He hunted animals for food and clothes. He hunted many kinds of animals and ate their flesh. In the course of time, he hunted certain kinds of animals more than others because he found that those animals were easier to hunt or their flesh tasted better than that of others. He also developed a taste for the milk and eggs of animals. He spent most of his time in search of animals and their products.

Eventually, early man found that if he could keep some animals with him to be used when required, it would save much time. Naturally, this led to trying different kinds of animals and selecting the most suitable ones. This might appear to be a very simple affair today. But such ideas could be expected to develop only in the finest minds of primitive men.

Rearing the wild animals was not an easy job. The men doing it had to learn about the food and other habits of these animals. Whatever experience was gained by one was passed on to another orally. Thus the domestication of the animals began.

Some of these early men behaved as scientists do today. They were constantly observing facts about animals. They drew certain conclusions from their observations. The experiences gained were communicated to others.

That is how the story of domestic animals began. We see domestic animals of different kinds. They yield products in different amounts. Thus some kinds of hens yield more eggs than others and different breeds of cows yield different quantities of milk.

After having successfully domesticated the animals, man is not content to take whatever quantity of product the animal yields. He wants to get more products from the animals. He tries different means of increasing the production. He feeds the animals with different kinds of food, observes the results and from these observations he comes to certain conclusions. He further tests his findings under typical farm conditions. He selects those varieties of animals that have the capacity to yield more products. He raises the youngones obtained from these selected animals. Thus better types of animals are obtained.

The scientists who carry out this work today write about their findings in books and journals. These are read by other similar scientists. They make use of these findings in their work and thus avoid wastage of time. Although primitive man did not publish his findings in books he often worked as a scientist; he observed and experimented and thought and discussed with others to find better ways of doing things.

UNIT 9

ANIMAL LIFE

CLASS III

Overview

By the time they reached class III, the children have begun to organize their information about animals. They have seen the diversity of animals and the general features of different animal groups. They have gained an elementary idea about the basic life-requirements of animals. They have also seen how animals effect their lives. They have observed very closely and learnt about the life of domestic animals. They have briefly surveyed the most common wild animals and compared their way of life with that of domestic animals.

One of the themes that runs through this entire unit concerns the food and feeding habits of animals. In classes I and II, the children learnt about the materials which animals eat. In class III they begin to understand *how* animals eat their food. In the later classes, they will learn how the mouths of animals are adapted to the type of food they eat.

Having learnt about the ways of feeding and the types of food, children are helped to understand what substances the food materials contain. An elementary notion about the composition of food gives children a chance to know that some food items contain large quantities of body builders, while some others contain energy givers and so on.

A major part of this unit in class III deals with the life of birds. Birds form a fascinating group of animals. They are present everywhere and can be easily observed by children. The main purpose of this material on birds is to help children to see and understand birds as a group of animals adapted for a special way of living. The habits of living of birds differ. The different parts of the body like the beak and feet are adapted to these habits. Children will observe how birds construct nests and care for their young ones till they are able to fly.

Short accounts about some of the most common and interesting birds are scattered throughout this class level. These sections can provide the teachers with interesting information about these birds. This could be used in explaining the ways of birds while helping the children to observe them in the fields. The children should not be compelled to memorize or read these sections as a part of their textbook.

1. DIFFERENT ANIMALS REQUIRE DIFFERENT TYPES OF FOOD FOR PROPER GROWTH

Animals are living things; they grow. Food is essential for their growth. It also helps to keep them strong and healthy. Food materials are of different types. Some food items make the body of animals grow big. Certain others make the bones and teeth strong. There are food items that keep an animal healthy—free from disease. Animals and their organs like the heart and lungs are constantly working. Energy is needed for all these. This energy is obtained entirely from food.

Growth is not merely a matter of growing big. It also includes growing strong and healthy. Various food materials are needed for proper growth of animals. All the required food items may be present in one food material. For example, lions, tigers and wolves live on animal flesh. They grow properly and remain strong and healthy. But very often certain food items help only in certain aspects of the growth of animals. Therefore, different kinds of food items are needed by animals for proper growth. This is particularly true of man.

Man depends upon domestic animals for many things. He can obtain maximum benefits from them only when he gives them proper and sufficient food.

1(a). ANIMALS NEED GOOD FOOD AND ENOUGH FOOD IF THEY ARE TO PERFORM PROPERLY

Children are very well acquainted with the various uses of domestic animals. Man wants to get the maximum benefit out of these animals. One of the essential requirements of getting the maximum use of these animals is to keep them healthy. They should be fed with good food. Good food makes them grow properly. Animals also should be fed sufficiently. However good the food might be, unless they are given sufficient amounts the animals will remain underfed.

The following activities will help the children to understand the need for giving good and sufficient food to domestic animals.

Interview

What foods are given to cows?

Encourage the children to seek an interview with a farmer who owns cows. If there is a dairy farm nearby, the children can be helped to consult its chief. Ask the children to find out the various items of food given to cows during the milk-yielding period. Let them also find out whether different food materials are given to cows during the 'no milk' period. Help them to find out which of these items are given to cows in order to get more milk from them. Discuss this in the class.

Field Observation

Which food items increase the milk yield of cows?

Arrange a visit to the veterinary hospital. Help the children to find out from the surgeon the proper food items that help cows to give more milk. Encourage the children to find out from the surgeon the items of food that help an ox and a buffalo to keep healthy and do more work.

Field Observation **Are most of the cows in our locality well fed?**

Help the children to find out from a nearby veterinary surgeon the features of a well-fed cow and those of an underfed cow. Encourage the children to draw conclusions as to whether the majority of cows and buffaloes found in their village are well-fed or underfed.

1(b). PROPER NOURISHMENT HAS TO BE GIVEN TO HENS SO THAT THEY CAN LAY MORE EGGS

Some breeds of hens lay more eggs than others. Even the best egg-yielding hens will not lay the maximum number of eggs unless fed with proper and sufficient food. Scientists engaged in poultry research are constantly trying to find out the food items which will yield more eggs. Poultry feeds are also manufactured and sold in the market.

The activities mentioned below will help the children to realize that hens need proper nourishment.

Interview **What is good poultry feed?**

Encourage the children to seek an interview with a poultry specialist in his farm. Let the children find out the various food materials given to hens. Help them to discuss with the specialist familiar and simple experiences in which food was found to be responsible for increasing the capacity of hens to lay more eggs.

Obtain the poultry feeds available in the market. Tell the students what they contain.

1(c). THE STAPLE FOOD OF MANY ANIMALS AND MAN IS OBTAINED FROM GRASS PLANTS

All animals, including man, depend upon plants for their food. Some animals feed directly on plants. There are other animals that live on the flesh of animals which in turn are dependent upon plants. Thus even the flesh-eating animals are indirectly dependent upon plants. Among the various groups of plants that are useful to animals, the most important is the grass family. This group includes wheat plants, paddy plants, maize, oats and millet plants. Animals like cattle, horses, sheep, goats and deer, eat grasses. Grains like wheat, paddy, maize and millets are eaten by rats, sparrows, crows, pigeons, fowls and a number of other animals. A large number of insects eat the leaves of grass plants. Insects also eat a number of grains. Man depends largely upon the products of the grass plants.

Help the children through the activities mentioned below to learn that grass plants form the staple food of many animals.

Class Project

To what extent do animals depend upon grass plants?

Ask each child to collect a small quantity of food materials obtained from grass plants. Help the children to put the collected materials individually in transparent cellophane packets. Encourage the children to arrange them on a cardboard and label them neatly. On another cardboard let the children paste the pictures of the most common wild and domestic animals, cut out from magazines. Collect a small quantity of the food items of each animal. Let the children put each item in a small transparent packet. Arrange to fix the packets around each animal for which they constitute food. Discuss with the children and make them realize that many animals depend primarily upon these food products of grass plants. See Fig. 9-15.

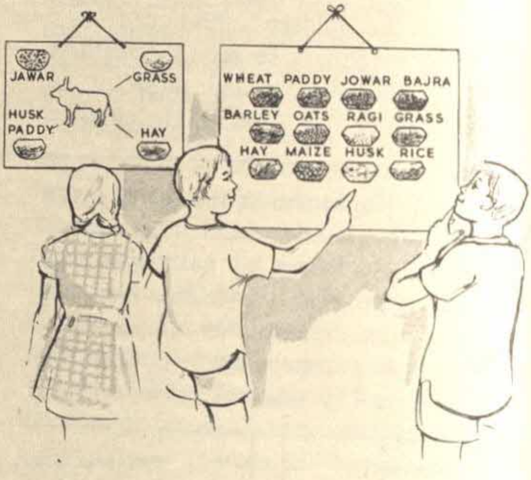


Fig. 9-15
Many food articles for man and other animals are obtained from the grass plants.

Help the children to collect small insects which eat the stored grains of paddy, wheat, maize, corn, barley, and millets. Help them to display these in the classroom.

Class Project

What kinds of food do caterpillars eat?

Materials required
caterpillars
boxes

Collect different kinds of caterpillars found on various grass plants. Leave them in small boxes with holes at the top to allow passage of air. Feed the worms with the parts of the plant on which they were found. Watch what happens to them in the course of time. When some fully grown insects come out, collect and preserve them. Collect all such insects from other children of the class. Note that there are different kinds of insects which depend upon grass plants. Do not undertake to find out the names of these insects. It will be difficult at this stage.

1(d). THE FOOD OF SOME ANIMALS IS MAINLY FLESH

Animals like lions, tigers, leopards, wolves, foxes, and vultures live exclusively on the flesh of other animals. Animals like bears, eagles, dogs and cats prefer the flesh of other animals.

Through the following activities the children will be helped to understand the above sub-concept.

Discussion

Which of the animals eat mainly flesh ?

Help the children to recall the names of animals that eat flesh. Discuss how they get their prey and eat them. Show them pictures of animals hunting their prey and eating them.

Encourage the children to visit a nearby zoo to see the food and the feeding of different animals.

1(e). THE FOOD OF ANIMALS SHOULD CONTAIN BODY BUILDERS, ENERGY GIVERS, AND HEALTH PRESERVERS

It is a common experience for children to see animals growing. Calves grow into either cows or oxen. Chicks grow into hens or roosters. They grow in height and length. They also gain in weight. They grow strong and continue to be healthy as long as they are given proper food. If their nourishment is defective in any important food item a particular aspect of the growth of the animal is affected. Man too requires different food items for his growth.

The following activities will help the children to learn that animals require different food materials for proper growth.

Familiar Experience

How are food materials classified?

Materials required
small animals
food
boxes

Help the children to recall the various food materials eaten by man. Write their names on the blackboard. Group them as pulses, cereals, fruits, vegetables, and animal products (meat, milk, eggs). Consider the cereals as energy givers, animal products and pulses as body builders, etc. Classify fruits and vegetables as health maintainers. Discuss that for proper growth of man, these various materials are needed.

Discussion

What do we know about the foods of domestic animals?

Arrange a group discussion in the classroom. Help the children to list the various food materials eaten by domestic animals. Guide them to classify the foods of animals as energy givers, body builders, and health maintainers. Help them to realize that many common foods serve two or three of these functions.

Investigation

How does a deficient diet affect animals?

If facilities exist, it will be a challenging experience to rear either white rats, or guinea-pigs or chicks. Help the children to select two specimens of any one of the young animals mentioned above. Both the specimens selected should be of identical size and should come of the same parent. Let the children keep them separately, feeding one with all the three major food items. The other animal should be fed with body-building and energy-giving food items only. Help the children to compare the growth of these animals after a few weeks. Help the children periodically to measure the weight and height of these animals and record them properly.

Class Project

What is the effect of a deficiency of certain food items?

Obtain photographs of the animals that were fed with only one or two of the three essential food items. Help the children to compare these with the appearance of a normally fed animal. Photographs of such animals are very often published in many biology books and journals.

Encourage the children to prepare an album entitled 'Our Food'. Help the children to arrange the pictures of various food materials in three main groups: energy givers, body builders and health maintainers.

2. ANIMALS EAT IN DIFFERENT WAYS

Animals belong to different groups like mammals, birds, reptiles, insects, etc. The animals belonging to the same group have some features in common. But one group differs from the other in many ways. One obvious way in which animals differ is their feeding habits. Some animals simply swallow the whole food. There are others that tear the food first and then swallow it. Some grazing animals first eat their food hurriedly. Later they sit leisurely, bring the swallowed food back into the mouth, and chew it. All these animals eat solid food.

There are a number of other animals that live on liquid food. Such animals suck the liquid food. Some animals are in the habit of licking the liquid food. To find out the nature of the food of an animal one need not always watch it. The structure of its mouth and teeth tells much about its feeding habits. The mouth and teeth are adapted to the nature of the food the animal eats and the way in which it eats it.

2(a). SOME ANIMALS SWALLOW WHOLE FOOD

Some animals eat other animals whole, perhaps while the victims are still alive! They do not chew or grind or tear what they eat. Such animals include snakes, frogs, lizards, and kingfishers. Snakes eat rats, frogs and worms. Lizards and frogs catch insects and other small animals with the help of their tongue. If the kingfisher spots a fish it plunges into the water and comes out with the fish in its beak. It swallows it whole. The following activities will help the children to observe and understand the above kinds of feeding habits.

Observation **How do snakes eat their food?**

Allow a snake charmer to bring his snake to the class. Let him feed it with any small animal like a rat or a frog. Help the children to observe how the snake eats. Refer back to Fig. 9-5.

Encourage the children to observe how kingfishers, frogs and lizards feed. This could be easily observed in the vicinity of the school. Discuss the various items of food eaten by these animals.

For Better Understanding

Frogs catch their prey with their tongues. Their tongues are sticky. The tongue is shot out at the prey. The prey sticks to the tongue. The tongue along with the food is drawn into the mouth. The whole prey is then swallowed.

Some snakes are capable of swallowing animals that are much larger than they are. At the junction of the upper and lower jaws of snakes there are elastic joints. These extend greatly and allow large animals to pass in. Once fed with sufficient food, a snake can go on without food for weeks, or even months.

Sometimes poisonous snakes kill their prey with their poison. Then they swallow the prey with the poison. The poison does not harm the snake. One of the salivary glands of such snakes is modified as the poison gland. The snake poison affects human beings and other animals only when the poison gets into their blood stream. Even human beings can swallow the poison of snakes without any danger, provided there are no cuts or ulcers in the food canal.

2(b). SOME ANIMALS TEAR THEIR FOOD AND THEN SWALLOW IT

A number of animals live on the flesh of other animals. These include lions, tigers, cats, foxes, wolves, dogs, etc. Lions and tigers chase their prey and kill them. Their mouths are too small to eat the animal they kill as whole. The flesh of their prey is torn into pieces with the help of their sharp pointed teeth and claws. Dogs and cats being domesticated can accept a variety of food materials. However, they prefer animal food. The structure of their teeth and claws are adapted to flesh-eating. Birds like owls, kites and vultures tear and eat the flesh of animals. They have strong curved beaks to tear the flesh and sharp claws to hold the prey. None of the above mentioned animals actually *chew* the food. They simply swallow it in small pieces.

The following activities will be useful to help the children to learn the feeding habits of the animals that tear and swallow their food.

Field Observation

How do cats and dogs eat meat?

Encourage children to watch either a cat eating a rat or a dog eating a piece of meat. Help them to observe the teeth that are used in tearing the meat.

Field Observation

How are the teeth and claws of a cat suited for eating the flesh of animals ?

Bring either a cat or a dog to the classroom. Make sure that the animal selected is not of an aggressive type. Show the children the teeth of the animal. This can be done by merely lifting its upper lip. Point out its strong jaw and sharp claws. Help the children to appreciate that the teeth and claws are adapted for tearing and eating the flesh of other animals. See Fig. 9-16.

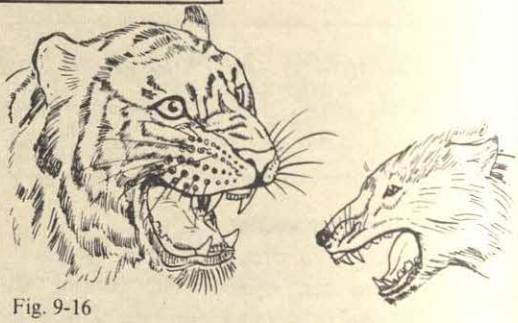


Fig. 9-16
Some animals have sharp, pointed teeth and claws to tear and eat the flesh of other animals.

Arrange a visit to a nearby zoo. Encourage the children to observe the way the animals eat. This could be observed during the feeding hours of the zoo animals. Discuss with them the adaptation of animals for securing and eating food.

For Better Understanding

Note in the diagram that animals have different types of teeth. Each type of tooth is given a name. The diagram given here is that of an animal that tears and eats flesh. Note that the canine teeth are well developed. These teeth help the animal to tear the flesh of its prey.

2(c). SOME ANIMALS NIBBLE PLANTS AND THEN CHEW THE CUD

Most animals swallow their food; then the digestive process takes place in the stomach and intestine. Some other animals eat their food hurriedly. Later they sit, bring the food back into the mouth and chew it leisurely. Such an act is called *chewing the cud*. Such animals are called *ruminants*. These include some of the domestic and wild animals. Cows, buffaloes, goats, and sheep are examples of domestic ruminants. Antelopes and deer are example of wild ruminants. These animals have sharp cutting teeth in front. These teeth help in cutting the grass. They have broad teeth with uneven tops at the back. These help to grind the food.

The following activities will help the children understand the habit some animals have of chewing the cud.

Field Observation

What is meant by chewing the cud?

Encourage the children to observe the ways of eating practised by cattle. Later at home let them observe the chewing of the cud. Discuss with them the various animals that chew the cud.

Help the children to see the nature of the teeth of animals that chew the cud. This can be easily seen on a water buffalo or cow or bull. Help the children understand that the teeth are adapted to the animals' way of eating.

2(d). SOME ANIMALS LIVE MAINLY ON LIQUID FOOD

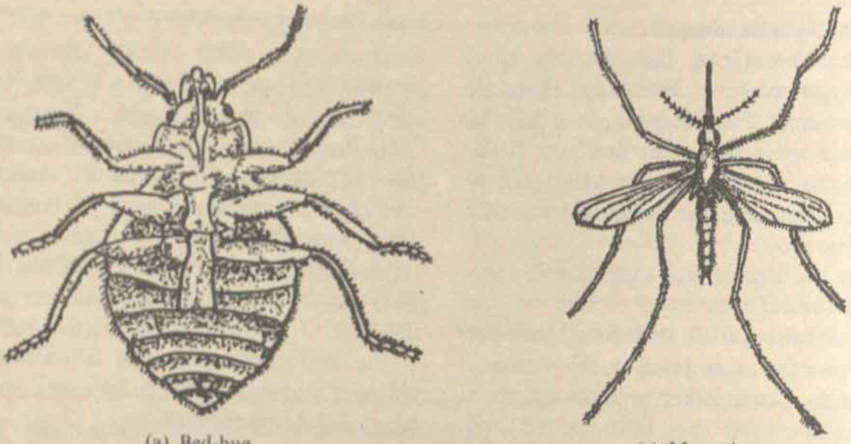
There are certain animals that do not take solid food. These animals live on liquid food. Such animals are leeches, mosquitoes, bed-bugs, ticks, butterflies and bees. Leeches suck the blood of human beings and other animals. Female mosquitoes, bed-bugs and ticks such the blood of human beings and other animals. Butterflies and bees suck nectar from flowers. The animals mentioned above suck liquid food. The following activities will help the children to learn about the habits of animals taking liquid food.

Investigation

What is the food of mosquitoes and bed bugs?

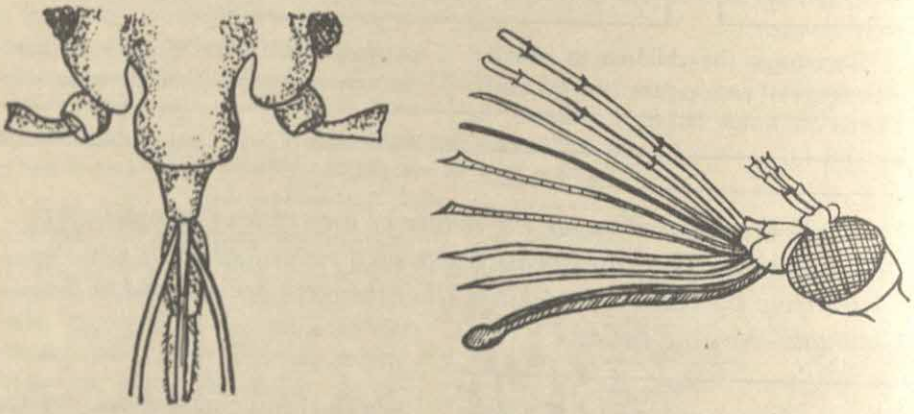
Materials required
live mosquitoes and/or bed-bugs

Help the children to recall the biting habits of mosquitoes and bed-bugs.



(a) Bed-bug

(c) Mosquito



(b) Bed-bug's mouth parts

(d) Mosquito's mouth parts

Fig. 9-17 a-d
Mouth parts of a bed-bug and a mosquito.

Discuss with them that the biting results in sucking the blood from the animals. Help the children observe the presence of blood in the fully fed mosquitoes and bed-bugs. This can be demonstrated by squeezing the animal.

Help the children to find out that red blood is absent in mosquitoes or bed-bugs that have not eaten food recently. Help the children to observe the mouth parts of mosquitoes and bed-bugs. See Fig. 9-17 a-d.

Field Observation

What is the food of butterflies, moths and bees?

Encourage the children to observe butterflies, moths and bees visiting flowers. Help them to notice the presence of nectar in flowers. Discuss with them how insects visit flowers mainly for nectar. Nectar is a liquid food. Help the children observe the long, coiled, tube-like mouth of butterflies and moths and a dead bee. See that the children handle it carefully. The bee has a stinging apparatus at its back end. Help the children to observe the honeycombs and honey. Help them to realize that large quantities of honey are collected by the efforts of these tiny insects. See Fig. 9-18.

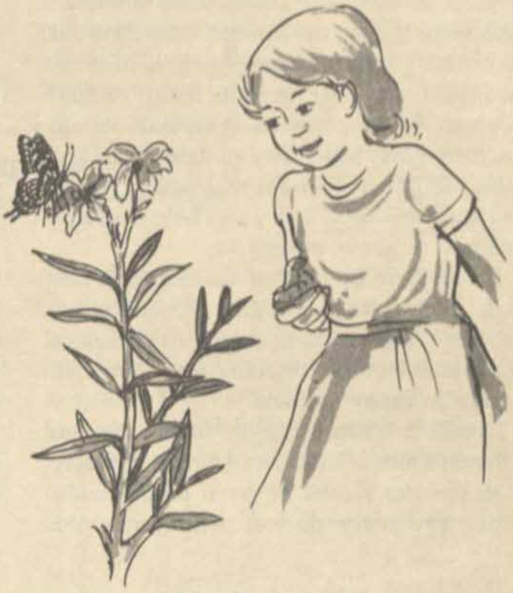


Fig. 9-18
A butterfly lives on the nectar from flowers.

Help the children to observe leeches in fields and ponds and to see their blood-sucking habits. Help them to compare the increase in size in leeches that are fully fed with those that have not taken their food yet.

Help the children to observe ticks as parasites on dogs, cattle and sometimes on human beings. Discuss with them that these suck the blood from the host animals.

3. DOMESTIC ANIMALS REQUIRE CARE

Wild animals are constantly in search of their food. Children have seen animals like crows, sparrows and squirrels frequenting human dwellings for food. They have also seen a large number of animals like lizards, frogs, snakes, vultures, etc., constantly going in search of food. Some animals like field rats, ants, and bees store their food. They use it whenever they need it. Man needs the services of domestic animals. He does not ordinarily allow them to find their food for themselves. Man provides food to his domestic animals. Another necessity for all animals is water. Water provided to animals should be clean. Dirty water may contain germs and other substances harmful to animals. Proper and sufficient food and water help domestic animals to grow healthy.

Proper care by man of the domestic animals enables them to give the maximum service. When sufficient care is not taken of these animals, they become weak and fall a prey to many diseases.

Domestic animals might fall a prey to different kinds of diseases. Animals suffering from diseases should be given proper treatment. Veterinary doctors who know the ailments of various animals should be consulted for treatment.

3(a). PROPER SHELTER SHOULD BE PROVIDED TO DOMESTIC ANIMALS

Domestic animals drop their excreta wherever they are kept. These excreta give a foul odour. Flies and mosquitoes gather near these places. The excreta harbour harmful germs. Therefore, it is not hygienic to have domestic animals near human dwellings. They should be kept away.

Domestic animals should be provided with proper shelter. Shelter protects animals from the sun, rain, cold and strong wind. Animals exposed constantly to the sun, rain and cold often become weak and diseased.

The following activities will help the children to realize the need for proper shelter for domestic animals.

Discussion

Why do animals need shelter?

Help the children to recall their experiences with shelter for cattle, horses, poultry, and pet animals. Help them to discuss the need for shelter for animals and the necessity for keeping it away from human dwellings.

Field Observation

Let us explore the sanitary problems of animal shelter

Encourage the children to visit nearby shelters provided for domestic animals. Help them notice their good or bad features. Help them to use the facts of these shelters being near or away from the human dwellings, protection of animals from cold, heat and wind, as the basis for assessment. Let them find out how many animal dwellings have suitable sanitary facilities.

3(b). CLEAN DRINKING WATER SHOULD BE PROVIDED FOR ANIMALS

All living organisms need water. Water is needed for various life activities. Most animals drink water. Water may be clean or dirty. Dirty water may contain disease-causing germs. When dirty water is given to animals, they often develop diseases. Domestic animals are a part of man's wealth. They should remain healthy. Therefore, they should be given clean drinking water. The children can be helped to understand the above sub-concept by performing the following activities.

Investigation

What does dirty water contain?

Materials required
water samples
glass tumblers

Help the children to take two glass tumblers. In one pour some clean water. In the other pour some dirty water. Keep them apart for some time. Let the children observe the sediments which have settled at the bottom of the glass tumbler containing dirty water. Help the children to compare it with clean water in the other glass. Discuss with them the occurrence of harmful germs in dirty water. However, even water which appears clean may be impure. The children should be helped to realize that apparently clean water too may contain harmful germs, since germs cannot be seen with the unaided eye.

Encourage the children to ***observe*** *how the different animals meet their need for water and the different methods of drinking used by different animals.*

3(c). ANIMALS SHOULD BE PROPERLY GROOMED AND CARED FOR

Domestic animals frequently become dirty. They should be periodically scrubbed and given baths. If animals are kept clean, they remain healthy. Healthy animals give the maximum service. Dirty animals develop skin diseases. Their hair may fall off and they may become sickly. When one animal becomes sickly its disease may spread to other nearby animals.

Help the children to perform the following activities to realize the need for keeping animals clean.

Field Observation

How do domestic animals become dirty?

Encourage the children to observe the habits of domestic animals and to find out how many animals become dirty. Help them observe how animals

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are groomed and kept clean. Discuss with them the need for keeping animals properly groomed.

Encourage the children to keep a pet animal in their school. Help them provide it with food and water regularly. Show them the ways of keeping the animal clean.

3(d). SICK ANIMALS SHOULD BE TREATED

Animals fall sick, just as human beings do. Sick animals should be given proper treatment. The diagnosis of the disease of animals is done by a doctor, called a veterinary doctor. He gives the sick animals medicine. There are 'animal hospitals' for the treatment of animals. These hospitals are called ***veterinary hospitals***. The following activities will help the children learn how sick animals are given medical treatment.

Field Observation

How are sick animals treated?

Arrange a visit to a nearby veterinary hospital or dispensary. Let the veterinary doctor help the children see the diseases of domestic animals. Help the children to observe how diseases of animals are found out and how medical treatment is given to animals.

Ask the local farmer to explain how he treats sick animals. How does he care for them when they have had cuts or other accidents ?

4. THE STRUCTURE OF BIRDS IS SUITED TO THEIR FLYING HABITS

Children see many varieties of birds around them. They see birds flying from one place to another. Excepting bats, birds are the only animals capable of flying well. A few kinds of mammals, lizards and fishes, can glide short distances in the air. Birds fly in search of food. They fly away for protection from enemies and bad weather conditions. They also fly to find suitable places to build nests.

Birds are able to fly due to their body structure. Many animals have four limbs. In birds the fore-limbs are modified as wings. The shape and structure of the wings are adapted for flying. The tail of a bird also has feathers. It helps a bird in its flight. The bones of other animals are generally heavy but in birds they are light, due to air spaces inside them. The light bones enable the birds to fly easily.

4(a). SOME BIRDS FLY AT GREAT HEIGHTS AND SOME AT LOWER HEIGHTS

Children are familiar with sparrows, parakeets, mynas, vultures, and kites. Sparrows, parakeets and mynas fly at fairly low heights. Vultures are very large birds. Eagles, kites and vultures fly at great heights. From such heights, they make a search for food.

The following activities can help the children to understand the flying habits of birds.

Field Observation

Which birds fly high? Which ones fly low?

Encourage the children to observe and report the names of familiar birds that fly at great heights and those that fly at lower heights. Help them to see most common birds of these two groups.

Discuss the names and habits of the most common birds which the children might have seen but whose names and habits they may not know. Help the children to collect pictures of birds and make an album.

For Better Understanding

There is a very large number of birds. Some of them are commonly found almost everywhere. Short accounts of some of the birds with interesting habits are given here. The teacher might see them to create students' interest in bird watching.

Myna: This is a most familiar bird for the children. It has a dark brownish body. It has a bright yellow bill and a yellow patch around the eyes. There is a large white patch on each wing. It builds its nest in the holes in a tree or wall. They are lined with roots, twigs and paper. Its eggs are light blue in colour.

Redvented Bulbul: This is a small bird, smoky brown in colour. It has a slight crest and a red patch under its tail. It can be seen on trees flying from branch to branch seeking fruits and insects for its food. It prefers gardens and parks. It builds cup-shaped nests in bushy plants. It lays two to four spotted, pinkish white eggs.

Babblers or Seven Sisters: The babbler has a dull, ash-coloured body. It has the habit of scrabbing among dead leaves for insects like cockroaches and moths, and for worms. The colour of the body merges with the colour of the brown dead leaves. These birds are always seen in groups of six or seven. Therefore, they are called 'seven sisters'. Their tails are long and flop loosely as they hop about in noisy companionship. When an animal or bird attacks any one of the babblers, all the six or seven join together to fight off the enemy. They build their nests in leafy trees like the mango. The nest is an untidy cup of twigs, grass and roots.

Black Drongo: These birds have shining black bodies and long tails. The tail is deeply forked at its end. They eat insects only. They sit on telegraph wires, fences, posts, or on grazing buffaloes. They are much smaller in size than crows. But when they sight a crow, they chase and attack it. Crows fly away. Their nests are cup-shaped, made of twigs and grasses, and held together with cobwebs.

4(b). SOME BIRDS FLY LONG DISTANCES AND SOME FLY SHORT DISTANCES

Birds often fly to find food. Usually, the birds get food in their neighbourhood. During certain seasons when the weather is either too hot or too cold, food may not be easily available. Under such conditions some birds fly long distances. Not all birds are capable of flying long distances.

Help the children to understand this sub-concept by undertaking the following activities.

Field Observation

Which birds are capable of flying long distances?

Help the children to recall their observation that domestic fowls do not fly long distances. Help them to observe some wild birds flocking on the trees during the night. During the day many birds go to fields and nearby places in search of food. Discuss and give examples of birds capable of flying long distances—storks, wild ducks, wag-tails and sea-gulls.

Encourage the children to observe the flocks of birds flying during certain seasons. Help them to observe the 'V' and similar formations during flights. Discuss the significance of such formations in helping to overcome the resistance of the wind and thus make flying easier. See Fig. 9-19.

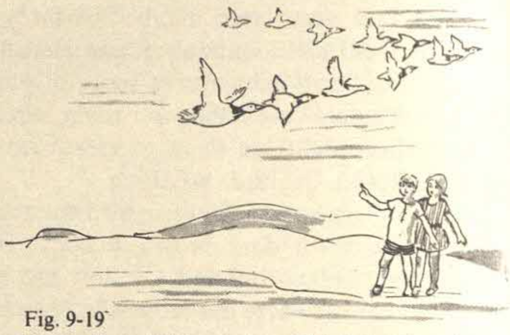


Fig. 9-19

Ducks fly in 'V' formation which helps them to overcome the resistance of wind.

4(c). WINGS AND TAIL FEATHERS ENABLE BIRDS TO FLY

Winged animals alone are capable of flying. Wings are the organs of flight. Many animals have wings. Bats and insects also have wings. But the wings of birds are different. They are covered with feathers. The wings are attached internally to muscles. They are capable of to and fro and up and down motions for flight. The tail is well developed in many birds. The tail is composed of feathers and is useful mainly for changing the direction of flight and also for certain adjustments during take off and landing of birds. The following activities will enable the children to learn about the importance of wings and tails of birds in flight.

Class Project

Let us study bird feathers

Materials required
feathers of birds
album

Help the children to collect feathers of different birds for preparing a feather album or a display of feathers. Guide them to identify birds from their feathers and mount the different types of feathers collected from the same bird. Lead the children to appreciate the lightness of the feathers.

Investigation

How do birds fly?

Material required
any pet bird like
parrot or myna

Encourage the children to keep either a pet parrot or myna or bulbul in their school. Instruct them to take proper care of the bird. Allow the children to observe the bird with its wings outspread. Let the birds fly inside the classroom. Encourage the children to observe the use of wings and tail in flight. Discuss the nature of flight in birds on the basis of the experience of children.

4(d). HOLLOW BONES MAKE THE FLIGHT EASIER

The lighter the bird, the more easily it can fly. Birds are lighter because of their lightweight feathers. The bones that are generally heavy in other animals are lighter in birds, because of their hollow structure. Through the following activities, help the children to appreciate the importance of this sub-concept.

Investigation

How do birds' bones differ from other bones?

Materials required
bones of various
animals

Help the children to collect bones of animals like sheep, dogs, pigeons, hens, etc., and to notice the differences between the bones of birds and those of others.

Show the children a picture of the skeleton of a bird. If possible, the actual skeleton or a chart will be better than the picture. Point out the bones that give strength and lightness to the wings, legs and breast.

5. THE STRUCTURE OF AQUATIC BIRDS IS ADAPTED TO SWIMMING AND FLYING

Birds can be conveniently divided into three groups: tree birds, ground birds, and water birds. This classification is based on the place where the birds spend most of their time and obtain their food. Water birds are called aquatic birds. Most birds have body structures that help them in flying. Aquatic birds have, in addition, features adapted to swimming. The sub-concepts which follow are organized to make this idea clear to the children.

5(a). WEBBED FEET SERVE AS PADDLES

Ducks, cormorants, and storks are some examples of aquatic birds. Only certain aquatic birds actually swim in the water. Others, like storks and herons, spend their time standing in shallow water. Certain other birds take shelter in the vegetation found in the water. The legs of swimming aquatic birds are different from those of other birds. The swimming aquatic birds have webbed feet. These webs are of thin skin extending between the toes. These webbed feet act as paddles and thus help swimming in water.

The teacher can help children to understand through the following activities the use of webbed feet as paddles for swimming.

Demonstration

What is the nature of a duck's feet?

Arrange to get a live duck and a hen in the classroom. Help the children to observe the nature of the duck's feet. Let them compare them with the feet of a hen. Leave the duck in water. Let the children observe how the duck swims with the help of its webbed feet.

Investigation

How do webbed feet help birds to swim?

Materials required
metallic wire
membrane or rubber sheet

Prepare two frames from a metallic wire, as shown in Fig. 9-20. To one attach a membrane. This could be obtained from the bladder of a goat. The bladder is thick when obtained. It can be converted into a thin membrane by rubbing it with sand. Instead of a goat membrane, a thin rubber sheet like a piece of balloon can be used. Demonstrate the pushing of water with the two types of improvised tools. The one with the membrane attached pushes the water better. Discuss with the children that when the webbed feet push backward on the water, the animal moves forward. The same principle can also be demonstrated with the help of a pointed wooden rod and another wooden rod with one end flattened. See Fig. 9-20.

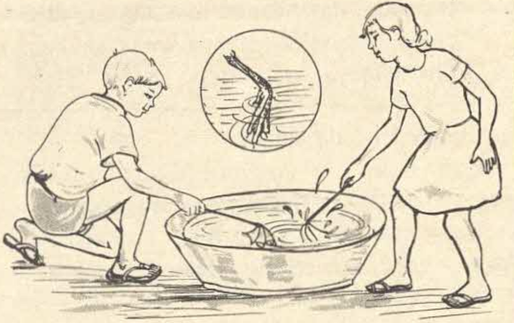


Fig. 9-20
Webbed feet help birds to move forward while swimming, by pushing backward on the water.

Encourage the children to prepare a clay model of a duck. Take care to see that they make the boat-shaped body, flat beak, and webbed feet.

5(b). AQUATIC BIRDS HAVE ONLY FEATHERS TO KEEP THE BODY DRY

Most birds get their feathers wet when they are in water. Aquatic birds spend most of their time swimming and splashing about in water. The kingfisher dives under water to catch fish. The feathers of aquatic birds do not get wet. The surface of the feathers are covered with an oily substance. Therefore, when the water comes in contact with the feathers, it is not absorbed. The duck remains dry, warm, and light in weight.

Help the children to perform the following activities in order to learn how the feathers of aquatic birds keep their bodies dry.

Investigation

How do oily feathers keep aquatic birds dry?

Materials required
paper
oil

Take two small pieces of paper. Rub oil on one piece. Sprinkle water over both pieces. Help the children to observe that the water soaks into the paper without oil. When oil is present, the paper does not get soaked.

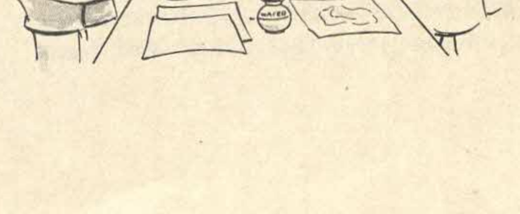


Fig. 9-21
A layer of oil prevents the soaking of water by the paper.

Instead, the water remains on the paper as droplets. If the paper is shaken, the droplets of water fall off. Help the children to realize that a somewhat similar thing occurs on the feathers of aquatic birds. See Fig. 9-21.

For Better Understanding

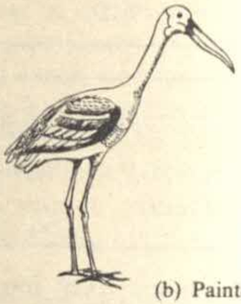
Short notes on common aquatic birds are given below for the benefit of the teachers. Teachers can identify the birds and tell the children about them to create an interest in bird life.

Ducks: Everyone is familiar with domesticated ducks. They are not capable of flying. They do not incubate their eggs and bring up their young ones. They have short legs, webbed feet and flattened beaks.

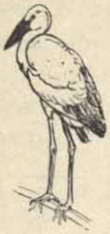
Wild ducks are sometimes found in lakes and ponds. There are many kinds of them with different colours and sizes. They come to our country during the winter season. They are capable of flying and building their own nests; they incubate their eggs and take care of their young ones.

Carmorants: Cormorants are black birds often found swimming and diving in ponds and lakes. They resemble ducks in their general body shape. They frequently fly and make much noice during their breeding season. They are very good at fishing. In Japan, these birds are trained to catch fish. The beaks are sharply hooked and compressed. The short legs are located far back on the body. Therefore, they appear extremely clumsy. They build nests on trees near water, and live in mixed colonies with storks and herons. Their eggs are bluish green. See Fig. 9-22a.

(a) Cormorant



(b) Painted stork



(c) Open-billed stork

Fig. 9-22 a-c
Some common Indian birds.

Storks: There are many kinds of storks. Thousands of them build their nests on trees near lakes. The trees may be thickly covered with nests. The commonly found types of storks are the painted stork and the open-billed stork. The painted stork has a long yellow bill. Its back and chest are mainly white. There is a black band across its breast. The wings are black. It is rose pink at the shoulders and wings. See Fig. 9-22b.

Open-billed storks are smaller. They are greyish white with black on their wings.

Their beaks are thick and long. Even when shut, there is a gap between the upper and the lower bill; hence the name open-billed. See Fig, 9-22c.

Storks feed on whatever is found in the mud—insects, crabs, snails, worms, fish, and frogs. All storks have long legs. While flying they keep their necks stretched out ahead, and their feet sticking out behind their tails.

6. THE BEAKS AND FEET OF BIRDS ARE ADAPTED TO THEIR EATING HABITS

Birds are of many different kinds. Even birds of the same kind may have different habits. The most easily observed habit of birds is the method of obtaining their food. Many birds eat grains and insects. There are some birds that eat the flesh of big animals, while others eat fruits. Some birds are specific in their food; others can accept a wide variety of food materials. Birds pick up their food with their beaks and their feet. These two organs—beaks (or bills) and feet—are of different sizes and structures in different birds.

Birds can be recognized by the colour of their feathers, shape, etc. A careful observer can tell a great deal about the food habits of a bird from the nature of its beak and feet.

6(a). THE BEAKS OF BIRDS ARE ADAPTED TO THE METHOD OF CATCHING AND EATING FOOD

The beak of a duck is like a strainer. It strains the mud out of the water, but retains food. The beak is suited for scooping and straining pieces of dead leaves, worms, insects and other small organisms found in ponds and tanks which form its food.

The beak of a hoopoe is long and curved. It frequently drives its beak sharply into the earth in search of insects. It feeds on worms, caterpillars, spiders, etc.

Vultures, kites, hawks, and owls are flesh-eating birds. The beaks of these birds are strong and the upper part of the beak is curved down. This helps the birds a great deal in tearing flesh.

Kingfishers feed on fish. Their beaks are long, thick, and strong. They are suited to catching the animals on which they feed.

House sparrows feed mainly on grains. This enables these birds to pick up the small grains of food, and to break them up if needed. Woodpeckers feed on insects. They make drill holes in the barks of trees and take out the insects found below the bark. Their pointed tongue helps them to do this. The beaks are long, strong and pointed.

Through the following activities, the children can be helped to learn how the beaks of birds are adapted to the food they catch and eat.

Discussion

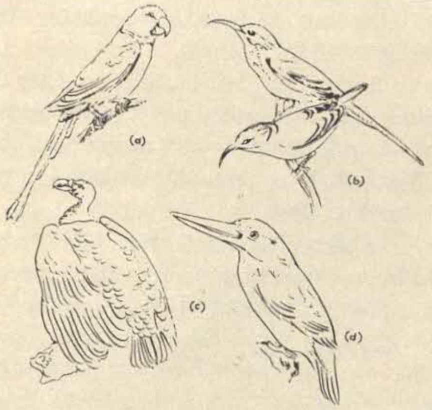
How are the beaks of birds suited to their food habits?

Help the children to recall the sizes and shapes of different kinds of birds they have seen. Show them pictures of the beak of a vulture, or a kite, sparrow, hoopoe, kingfisher, etc. If the preserved and mounted beaks of birds are available, they are better for demonstration. Discuss with the children the food of these birds. Encourage the children to talk about their experience of the feeding habits of birds. Through discussion help them to learn that the beaks are specially adapted for catching and eating the types of food on which birds live.

Class Project

Let us study the beaks of birds

Materials required
water colour or
colour pencils
pictures of beaks, or
models or specimens



Encourage the children to undertake a project to draw the beaks of different kinds of birds, paint them and label them. Collect the drawings and help the children to prepare an album. See Fig. 9-23.

(a) Parakeet
(b) Sun-bird
(c) Vulture
(d) Kingfisher.

Fig. 9-23
Some common interesting Indian birds.

Arrange a trip to a museum, if there is one nearby. Guide the children to observe the shapes and sizes of the beaks of birds. Discuss the nature of food of the birds observed. Help the children to understand that the beaks of birds are adapted to catch and eat the food.

6(b). THE FEET OF BIRDS ARE SUITED TO THEIR HABITS

Different birds have different habits. Many aquatic birds swim in water using their webbed feet as paddles. Some aquatic birds have long legs to enable them to wade in swamps and shallow ponds. The birds which make use of their feet to hold their prey have strong feet with long, sharp, curved talons. The birds that walk on marshy lands have long spread-out toes. This enables them to walk on soft mud without difficulty.

Help the children through the following activities to learn that birds' feet are suited to their habits.

Discussion

How are the feet of birds suited to their habits?

Exhibit a collection of preserved feet of birds that show some adaptation to their habits. The feet of eagles, owls, ducks, parakeets, etc., are good examples. Discuss the role of feet in swimming or holding the prey. Explain the adaptation of some birds' feet for perching on trees or walking on marshy land. Help the children to learn that the feet of birds are suited to their habits. See Fig. 9-24.

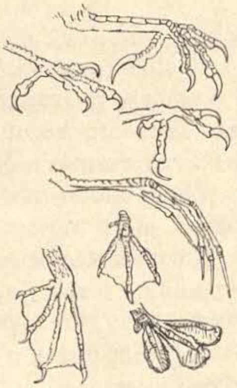


Fig. 9-24
The feet of birds are suited to their babits of swimming, walking on marshy land, or perching on trees.

Class Project

Let us study birds' feet

Materials required
plasticine
wooden board
specimens of feet of birds

Encourage the children to prepare models of the feet of birds with plasticine. Help them to arrange them on a board and label them.

Take the children to a zoo or museum, if there is one nearby. Help them to note the structure of the feet of birds as suited to their habits.

For Better Understanding

Here is come information about some of the common local birds.

Parakeets

These are common birds, green in colour with powerfully hooked red beaks. These birds are vegetarians and use their beaks to pick up fruit, grain and nuts. Another useful function of their strong beaks is to make holes in the trunks and branches of trees for building nests. Their eggs are laid in the hollows of tree-trunks. They vary in number from four to six, and are white in colour.

Parakeets use the foot as a hand while

eating and use the beak as the third leg while climbing. They can mimic words uttered by man remarkably well. This is responsible for their being popular as pets.

Sunbirds

Sunbirds are tiny birds with long, curved, thin beaks. They are often seen hanging head down from branches in search of nectar from flowers. They are beautifully coloured—bright green, red and purple on the head and back and yellow underparts. The female birds are olive green above and yellow below. During their search for nectar from flowers, they pollinate many flowers. They hang their nests from the tips of branches. The nest is an oblong pouch of soft grasses with a porched entrance. Its outside is covered with bark and other rubbish. They lay two eggs of a dirty white colour, with brown and grey markings.

Vultures

Vultures are large birds, brown in colour. Their head and neck are naked. Their wings are very large. Vultures build their nests in tall trees or on cliffs. The nest is a platform of twigs lined with green leaves. They lay single egg with reddish brown markings. Vultures fly high in the air in groups in search of their food. They feed on dead, decaying animals. A crowd of vultures collects around the dead animal and eats it. Such a crowd can peck and clean the bones of a dead buffalo in a few hours.

Kingfishers

The common kingfisher is somewhat larger than a sparrow. It has a brilliant blue colour and a long, strong bill. There is another kind of kingfisher, called the white-breasted kingfisher. These are larger than mynas, and have blue-coloured wings and white chests. The beaks are red. Kingfishers sit near the water and wait for fish. Some make a flying survey. As soon as a fish is seen, the wings are closed and the bird dives into the water. It then flies off with the prey in its beak.

Kingfishers build nests in earth banks. The nest is a long, narrow, horizontal tunnel. The eggs vary from four to six in number and are pure white in colour.

7. BIRDS HAVE DIFFERENT NESTING HABITS

The children have learnt that birds have different food habits. Their nesting habits are also different. It is indeed amazing that when a young one matures, it constructs the same type of nest as was done by its parents. Nests are primarily built for laying eggs and bringing up the young ones.

Birds build their nests in different places. Some build their nests near the water and some in trees. Other birds build their nests in holes in the walls of houses. Birds build their nests with grass, twigs, and leaves. Some birds use feathers in their nests. This makes a soft, warm place to lay their eggs. Hens and ducks do not build any nests. Hens sometimes lay their eggs on a soft spot of grass or straw which they find. The koel does not bother to build a nest at all, but lays its eggs in the nests of crows.

7(a). MOST BIRDS BUILD THEIR OWN NESTS

The children are familiar with different kinds of animals found in their surroundings. Unlike many other animals, most birds build their own homes (nests). However not all birds build nests. Hens, domestic ducks and partridges do not build nests. They simply lay their eggs on the ground.

Help the children to perform the following activities to learn that most birds build their own nests.

Class Project

Let us collect birds' nests

Encourage the children to collect the abandoned nests of birds. Help them to identify the nests and arrange to exhibit them in the classroom or in the 'nature corner'. If no nests can be collected, let the children collect pictures of birds' nests and prepare an album, entitled 'Home of Birds'.

Encourage the children to observe the homes of different types of animals. In class, discuss with the children the nature of homes of different animals. Help them to appreciate that among the animals, birds constitute a unique group, most of which build nests of their own.

Help the children to put up a nest box made of wood with a hole, or a hollowed husk of a coconut with a small hole in front. Set this 'bird house' out where it can be used by some birds for building nests.

7(b). BIRDS BUILD NESTS IN DIFFERENT PLACES

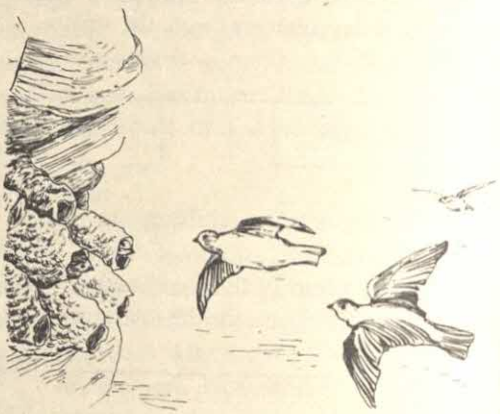
Birds like eagles, vultures, and kites build their nests either on tree tops or on stony hill tops. Owls build their nests in the holes of trees or walls, or on the ground in the shelter of bushes. Woodpeckers, parakeets, and mynas build their nests in holes in trees. Sparrows build their nests in any small hole in any part of a building or tree. Kingfishers build their nests on earth banks The jacana builds its nests on water. Thus birds construct nests in many places—banks of rivers or ponds, mountain tops, trees, buildings, or right on the water.

Help the children to learn through the activities mentioned below what a large variety of places is selected by birds for nest building and egg laying.

Observation

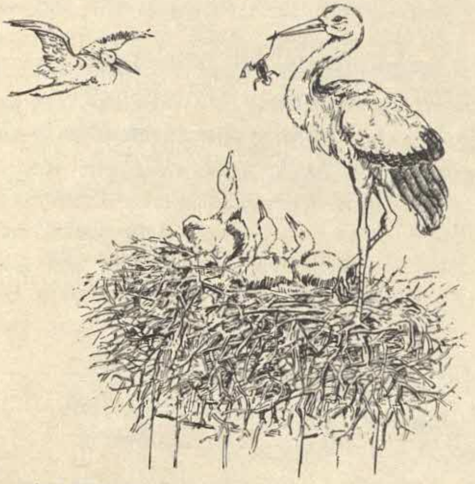
Where do birds construct their nests?

Encourage the children to observe the different places selected by different birds for building nests. Very often the nests are well hidden. The frequent visits of a particular bird with food in its mouth to some special place is an indication of the presence of a nest. Discuss in the classroom the different places where nests are built by birds. See Fig. 9-25 a-c.

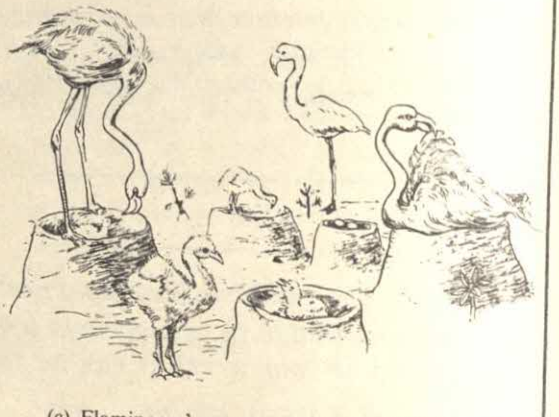


(b) Sand-martins' nest in colonies in sandy banks.

Fig. 9-25 a-c
Birds construct their nests at different places.



(a) A Stork's nest made in the open.



(c) Flamingoes' nests are made of scraped-up mud.

Arrange a visit to the nearby museum if there is one. Help the children to learn more of the different places that are selected by birds for building their nests. Usually in big museums the birds, their nests and eggs are put on display. The descriptions of the place where they are built and the materials used for building nests are also given.

7(c). BIRDS BUILD NESTS OF DIFFERENT MATERIALS

Grass, twigs and leaves are the chief materials used by birds for building nests. Some birds make use of mud. In addition, cotton, feathers, pieces of cloth or string are used as cushions for eggs and young birds.

The following activities will help the children to understand this sub-concept better.

Investigation

What materials are used by birds in nest-building?

Materials required
bird's nests

Help the children to collect bird's nests of different kinds and identify them. Ask the children to tell the names of different types of materials. Discuss and recall the places where the nests were found. Help them to appreciate the intricate workmanship involved in certain special types of nests such as those of the weaver-bird and the tailor-bird.

Class Project

Let us make a bird-nest book

Encourage the children to prepare a nature study booklet entitled 'Nests of Birds'. Let the children collect pictures of different types of nests and the birds that construct them. If there are some talented children who can paint some of the nests and birds, provide them with necessary facilities and guidance. Help them to write short notes on the habits of the birds, the places where the nests are built, and the material used for building them.

For Better Understanding

Here are some more notes about common birds in our country. See Fig. 9-26.

Koel

Koels are noted for not rearing their young ones. They lay their eggs in the nests of crows. The crow brings up their chicks. The male koel at the breeding time approaches a crow's nest. The crows chase the male koel; meanwhile the female koel lays her egg in the crow's nest. The crows never realize that the koel's eggs do not

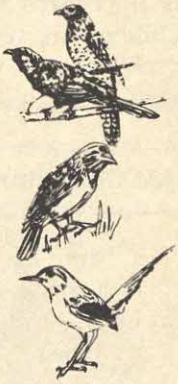

(a) Koel
(b) Weaver-bird
(c) Tailor-bird

Fig. 9-26
Some common interesting Indian birds.

belong to them. The male and female koels are different in colour. The male koel resembles a crow. It has a slimmer body and a longer tail than the crow. The beak is yellowish green and the eyes are blood red. The female koel is brown, with white specks. During the hot weather the breeding season of koels begins. Koels produce a loud insistent series of shrieks—ku-o-o-o-ku-ooo. Each shriek is higher than the previous one.

Weaver-bird

Weaver-birds are of the size of sparrows. They build their nests on trees overhanging a pond or tank or on any date or palmyra or palm tree. Large numbers of birds often build nests in the same tree or in neighbouring trees. They weave their nests out of bits of grass. The nests hang like inverted bottles.

Tailor-bird

Tailor-birds are small olive-green birds. To build a nest the birds select two broad leaves. The male with its sharp bill makes holes at the margins. Then strands of string-like material are passed through the holes and the edges of the two leaves are literally sewn together. Thus the two leaves form a tubular pocket. It is filled with soft material and two or three brown spotted eggs are laid in it.

8. BIRDS CARE FOR THEIR YOUNG ONES

It is a common knowledge for children that animals care for their young ones. Many pet animals care for their young ones but there are many other animals that do not care for their young ones at all. Such animals are frogs, crocodiles, snakes, turtles, insects, worms, etc. Birds are among the group of animals that take care of their young ones. They provide them food and shelter and protect them from enemies.

8(a). MOST BIRDS TEND THEIR YOUNG ONES

Children are very familiar with sparrows and pigeons. They build nests at the time of laying eggs. It is a familiar experience for the children to see these birds carrying twigs, grass, etc., to build nests. After the nests have been made they lay eggs. They sit over the eggs and incubate them. After the incubation. the young ones are weak, have no feathers, and are unable to find food for themselves. So the parents provide them with food. The nests built by them provide protection against wind, cold, and enemies.

This phenomenon can very well be understood by children by undertaking the following activities.

Field Observation

How do birds tend their young ones?

Invite the children to the backyard of a house which has a poultry shed. Let the children see the way the hens tend their chicks. Help them to observe how the hens help them to feed. Show the children how the hen warns its chicks to come near her when she sights any enemy. Sometimes she drives the enemy away. (Common enemies include cats, dogs, crows, eagles, etc.)

Encourage the children to observe sparrows and other birds carrying food to their young ones and feeding them.

8(b). YOUNG BIRDS ARE CARED FOR TILL THEY LEARN TO FLY

The young ones of birds take some time to get ready to fly. For many birds it requires a few weeks. The bodies of the young ones are nearly naked when hatched out from eggs. Gradually feathers grow and the wings become strong. Finally, they develop into sturdy young birds, ready to fly and seek their own food. Till that time, the young ones are fed by the parent birds. Even when they begin to fly, they are not able to do so perfectly. The parents help them in their flight.

The children can understand the above sub-concept better through the following activities.

Field Observation

How do pigeons and sparrows care for their young ones?

Help the children to see the young ones of either sparrows or pigeons at different stages. Point out that the newly hatched young ones are without much feathery covering. Help the children to watch the development of their feathers and wings and the young ones being fed many times a day by the parent birds. Let the children also observe that the parents do not care to feed them after the young ones are able to fly.

Find a young bird which is too small to care for itself, and has no parents. Urge the children to care for it until it is ready to fly away.

Scientists at Work

Food scientists serve mankind

You eat food of many different kinds. If somebody asks you why you eat different kinds of food materials, you might perhaps say that they have different tastes. This is a good answer. There is another reason for eating a variety of food. You have learnt that different food materials contain different kinds of substances. Some help the growth of body; some give energy for the various types of work done by the body. Some contain substances that help to maintain the health of our bodies.

How are these facts known to us? Scientists have revealed these to us. How do scientists come to know these facts? They come to know them through their work. They conduct experiments in their laboratories. They find out what materials different foods contain. They discover certain substances in food materials that were unknown up to that time.

When this happens, scientists want to find out how these substances affect the body. They select certain animals for their investigation. They select two sets of similar animals. To one set of animals, they give the normal food, without the substances discovered. To the other set, they give the normal food plus the substances they have discovered. They compare the growth of the two sets of animals and draw conclusions from their observations. After this, they carry out similar experiments on many sets of animals. They have to observe the results in many cases before they can be reasonably sure of their results. They communicate their discoveries to other scientists through books, journals, speeches, etc.

Thanks to food scientists, we are learning more and more about proper food for people and for animals. We are finding new food products, and also new and better ways to prepare familiar food products. We can all lead healthier and happier lives if we follow the recommendations of these food scientists at work.

UNIT 9

ANIMAL LIFE

CLASS IV

Overview

In classes I through III, concepts and sub-concepts were selected to develop in the children a broad awareness of the diversity of animal life. In addition to this, some of the characteristics of animals as living things were introduced gradually. The children have learnt through observation, investigation, and discussion the following behaviours:

(*i*) Animals move from one place to another.

(*ii*) All animals require food, though the needs differ with different animals.

(*iii*) Animals react differently to different situations; in other words they respond to stimuli.

Another important animal activity is reproduction. Reproduction means giving birth to young ones. This is the main theme of the major concepts in class IV. The idea of reproduction in animals is not new to the children. They have observed the young ones of some kinds of animals. In class IV, their knowledge can be organized. The ways in which different groups of animals reproduce their young ones are dealt with in an elementary way. This opportunity is taken to make the children conscious of parental care in animals. However, the children should not form an impression that all animals care for their young. The vast majority of animals leave their young ones to care for themselves. But these somehow manage to live. In other words, the continuity of life of these animals is maintained.

The animals adjust themselves to the surroundings in many other ways. To put it in other words, they are *adapted* to their surroundings. Adaptation is a 'key idea' in the understanding of the evolution of living things. The idea of adaptation is treated all through classes I to V. It is one of the key ideas in understanding animals in particular and living things in general.

1. ANIMALS REPRODUCE THEIR KIND

All living things, whether plants or animals, give birth to young ones. This process of giving birth to young ones is called *reproduction*. Reproduction differs in different groups of animals. Some animals directly give birth to young ones. These include all mammals, some kinds of fish and some snakes. Many animals like birds, reptiles, frogs, fishes, and insects lay eggs. After some time, the young ones come out of the eggs.

An interesting point about reproduction is that the young ones which are born resemble their parents. Thus a cow gives birth to a calf which grows and becomes a cow or bull. And birds lay eggs from which chicks hatch and grow and become adult birds just like their parents.

Insects lay eggs from which the young ones hatch out. These young ones are very different from their parents. They undergo changes in their body features until they become fully grown insects resembling their parents. Thus each animal reproduces its own kind.

1(a). SOME ANIMALS GIVE BIRTH TO YOUNG ONES

Children are familiar with mammals. Elephants, cows, dogs, cats, and rats are examples of familiar mammals. All these mammals give birth to young ones. In addition to mammals, certain other animals also give birth to their young ones. Sea animals like sharks, aquarium fishes like guppies and swordtails, and some snakes are such animals. The young ones of mammals suckle milk from their mothers. In all the animals mentioned above, the young ones develop inside the mother's body. When they are born, they are small, nearly helpless models of their parents. The following activities should be performed to help the children to understand this sub-concept.

Field Observation

Which of the animals give birth to young ones?

Ask the children to describe their pet animals. Discuss with the children the animals that give birth to their young ones. Take the children to any nearby place to show them the young ones of cats, dogs, goats, and pigs. Encourage the children to compare the features of these young ones with those of their mothers. Let the children also observe the ways in which these young ones obtain their food (sucking milk). Ask the children to mention the names of animals that give birth to their young ones. Write the names of such animals on the blackboard and discuss each.

Class Project

Let us raise white mice

Materials required
a pair of white mice or rats
cage
food

Help the children to rear either a pair of guinea-pigs or white mice or rats. Arrange to have one female and one male. Encourage the children to *feed them regularly and take proper care of them*. These animals give birth to their young frequently. Help the children to observe the growth of the young ones after they are born and to keep a record of their observations—the number of young ones born, their colour, the number of days required for their eyes to open, the appearance of hair on their body, etc.

1(b). SOME ANIMALS LAY EGGS

All birds, insects, reptiles, and most fish lay eggs. The eggs contain undeveloped young ones inside them. The bulk of the egg contains food material for the development of the tiny animal inside it. The young ones do not come out immediately after the eggs are laid. They take some days to develop inside the eggs. The eggs must be kept warm to permit the young ones (embryos) to develop. The birds sit on the eggs and provide them warmth. This is called *incubation*. The temperature of the surrounding atmosphere is enough to enable the eggs of reptiles, insects, and fish to develop.

The activities mentioned below will help the children to learn better that some animals lay eggs.

Class Project

What are some of the egg-laying animals?

Collect the eggs of different types of animals : birds, lizards, turtles, fish, and insects. Exhibit them with labels bearing the names of the animals. Find out whether any child has an egg-laying animal as his pet. Discuss the egg-laying habits of animals. Through pictures of animals and their eggs, help the children to appreciate that there are many animals that lay eggs.

Demonstration

What does an egg contain?

Materials required
eggs
mounted needles

Obtain a hen's egg that has been incubated for some days. Break open the shell. (Make a big hole so that the contents of the egg come out as a whole.) Show the children the yolk and the embryo. Point out the beating heart; help the children to realize that it is a living young animal inside the egg. Help them to realize that there are embryos in other eggs that have not yet developed. See Fig. 9-27.

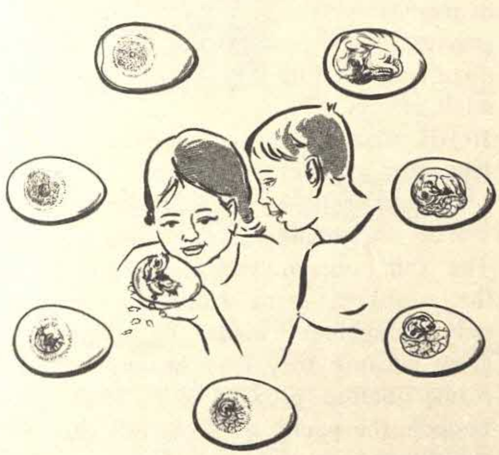


Fig. 9-27
A hen's egg passes through various developmental stages before the chick is hatched out of it.

Field Observation

How are hens' eggs incubated? How do chickens come out of eggs?

Take the children to visit a nearby house or poultry farm where hens' eggs are incubated. Help them to observe how the hen incubates its eggs and keeps them warm. Arrange another visit when the chickens hatch out of the eggs. If possible, an egg which is about to be hatched can be brought to the classroom so that the children may observe how the chick comes out of the egg.

Help the children to keep the eggs of turtles or lizards and observe the young ones hatching out. The eggs may be kept buried in sand which is warmed by the sun.

For Better Understanding

The eggs of hens may be fertilized or unfertilized. A fertilized egg contains a small living embryo inside. For the development of the embryo, constant warmth is required. A temperature of 38° -39° Celsius is required for the eggs to develop. The hens sit on the eggs and keep them warm. It takes about 21 days of incubation for the young chicks to come out of the eggs. It is possible to incubate the eggs without hens. There are devices called *incubators*. They keep the temperature constant. Eggs kept inside these artificial incubators hatch out the chickens. One great advantage of this artificial method of incubation is that a large number of chicks can be hatched. Another advantage is that the eggs can be incubated at any time without waiting for the hens.

1(c). INSECTS' EGGS PASS THROUGH VARIOUS STAGES BEFORE THEY MATURE

Insects also lay eggs. These are very small. There is one main difference between the young ones that hatch out of the eggs of insects and those that come out from the eggs of other animals like hens, lizards. The young ones of hens resemble the parents in many features, except that they are small in size and weak, and the feathers are not fully developed. The young ones that hatch out of many insects' eggs do not resemble their parents. They pass through one, two, or three stages before they finally develop into adult insects.

1(c) (i). SOME INSECTS LIKE GRASSHOPPERS PASS THROUGH A SERIES OF MOULTS

Grasshoppers lay eggs under the soil. The eggs hatch and the young ones come out. The young ones are very small and resemble the adults in many features. They have only rudimentary wings. The young ones grow because they feed heavily on green plants. Before growing into adult grasshoppers the young ones cast off their skin many times. Such an act of casting off the skin is called *moulting*. After each moult, the young insect develops a larger skin. The following activities can help the children to learn how some insects pass through a series of moults.

Class Project

Let us observe the life cycle of a grasshopper

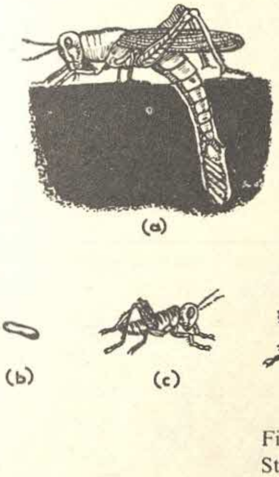
Materials required
wide-mouthed bottle or box
piece of cloth
soil
green plant

Help the children to secure a big wide-mouthed bottle or a box for rearing grasshoppers. The bottom of the bottle should be covered with soil to a depth of about 2-3 cm. A piece of thin cloth should be kept ready to cover the mouth of the bottle. The thin cloth prevents the grasshopper from escaping from the bottle but allows exchange of air.

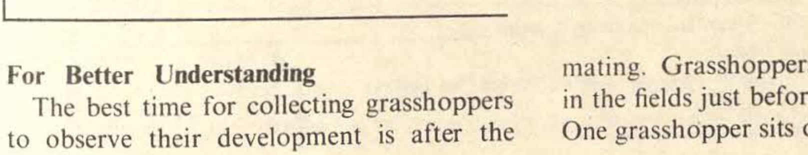
Help the children to collect some grasshoppers and shoots of the plants on which they frequently feed from the open fields. Let the children put these in the bottle and cover it. Instruct them to put in new shoots and remove the old ones from time to time.

Help the children to observe the cases of eggs laid underneath the soil and the young ones coming out. Encourage the children to observe the frequent moulting and the growth of young ones into adults.

Help the children to observe carefully small and large grasshoppers. Note the close resemblance between them. The young insects however do not have well developed wings. See Fig. 9-28 *a-e.*



(a) An adult grasshopper laying eggs underneath the soil.



(b) An egg.
(c) Nymph.
(d) Developing grasshopper.
(e) Fully-developed grasshopper.

Fig. 9-28 a-e.
Stages in the development of a grasshopper.

For Better Understanding

The best time for collecting grasshoppers to observe their development is after the mating. Grasshoppers can be seen mating in the fields just before the monsoon season. One grasshopper sits over the other, clasping it tightly. Such pairs might be picked up and reared to obtain the eggs. The eggs are laid in small cases underneath the soil. Therefore, the soil should be searched to pick out the cases. The young ones of grasshoppers are called *nymphs*.

1(c)(ii). INSECTS LIKE THE BUTTERFLY PASS THROUGH FOUR STAGES IN THEIR LIFE CYCLE

Butterflies lay eggs on the undersurface of leaves of plants. After a few days, the eggs hatch and the young ones come out. These are at first very minute and worm-like. They eat the leaves of plants and grow big. These are called *caterpillars* or *larvae*. After some days, the caterpillars stop feeding and get enclosed in a hard case. This is called the pupa or *cocoon*. After a few more days, the outer covering of the pupa bursts open and the butterfly comes out.

Help the children to understand the development of insects like butterflies through the following activities.

Investigation

What becomes of caterpillars found on green plants?

Materials required
shoe box
cellophane sheet
caterpillars
plant

Ask the children to obtain a big cardboard shoe box. Cut out the cardboard from one side and in its place paste a cellophane sheet. Make a few holes in the lid of the box. Invite the children to a trip to a field nearby. Encourage them to observe the caterpillars on certain plants. Help them to collect the eggs, the caterpillars and the leaves of plants on which they feed. Let the children put all these inside the cardboard boxes and feed the caterpillars daily. Help them to observe and keep a record of the number of days spent as a caterpillar and as a pupa.

Discuss the nature and number of legs of the caterpillar, its voracious feeding habits and the nature of the covering of the pupa. Help the children to observe the complete absence of any similarity between the adult, caterpillar and pupa stages. Let them also note how in the final stage the butterfly resembles the parent which laid the egg.

Help the children to draw simple sketches of the egg, larva, pupa, and adult stages of a butterfly. See Fig. 9-29.

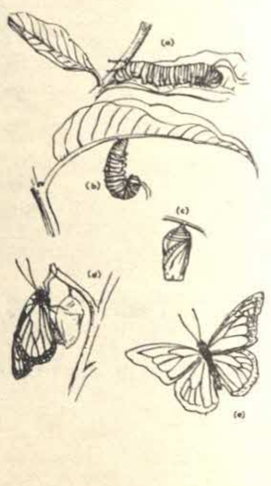


Fig. 9-29
Stages in the development of a butterfly.
(a) Caterpillar
(b) Caterpillar becoming a pupa
(c) Pupa
(d) Adult butterfly coming out of a pupa
(e) Butterfly.

2. SOME ANIMALS CARE FOR THEIR YOUNG ONES; OTHERS DO NOT

The young ones of many animals are weak and not fully developed. They are not able to protect themselves from enemies. Many of them are unable to procure their food as their parents do. Some animals take care of their young ones by protecting them from enemies and by providing them food. These include all the mammals and most birds. Most reptiles, amphibians and fish do not care for their young ones.

2(a). AMONG THE MAMMALS THE MOTHER SUCKLES THE YOUNG

Animals feed their young in different ways. One method of feeding is to provide them with the mother's milk. Such animals form a group. They have hair on the body. They keep their body temperature constant. They give birth to young ones directly and the young ones obtain milk from their mothers. Such animals belong to a group called *mammals*. Help the children to learn about mammals through the following activities.

Discussion

Which animals provide milk to their young ones?

Recall the children's experience of young animals and how they suck milk from their mothers. Help them to discuss the food of adult animals and contrast it with that of the young ones. Show the children pictures or charts of such animals suckling their young ones. Help them to classify such animals as farm animals, pet animals, pack animals, and harmful animals.

Discussion

What are the features of mammals?

Encourage the children to find out other features of animals that feed their young ones with milk. For this, select any four animals like a frog, a turtle, a chicken, and a cat or a dog. Help the children to compare and learn that the mammals give birth to young ones, and have hair on their bodies. Name three or four animals at a time and ask the children to tell which one is the mammal. Include man—also a mammal—in some of the name-groups.

Invite the children to an excursion to a nearby zoo if there is one. Guide them around and help them to observe the various mammals *kept there. Let the children watch the ways in which different animals feed.*

2(b). BIRDS TEND THEIR YOUNG ONES TILL THEY LEARN TO FLY

Many animals lay eggs. Birds are among them. Many birds build nests in which they lay their eggs. They incubate the eggs and the young ones hatch out. When hatched out the young ones are very small and weak. They cannot fly, since the feathers of the wings are not fully grown. The body is nearly naked. Thus they are not in a position to fly and search out their food, nor even to keep warm outside the nest.

The parent birds frequently bring food for the young ones. The parents protect them from rain and cold by covering them with their wings.

The following activities will help the children to comprehend the above sub-concept.

Field Observation **How do birds care for their young ones?**

Encourage the children to observe the birds coming to their nests with food in their mouths. What kinds of food do they bring? Discuss the need for the birds to build nests. Recall the children's experience of the various birds that build nests in their locality.

Field Observation **What care do young birds need?**

Help the children to observe the young ones of any flying bird. Ask them to find out the differences between an adult and a newly hatched bird. If possible, help the children to observe the development of any one bird from the hatched-out stage to that in which it can fly. Encourage them to observe the parents keeping watch over their young ones and attacking any hostile bird that comes near the place of their nest. Recall the children's experience of some other birds like crows or eagles carrying away the young ones of other birds for their food.

2(c). MANY ANIMALS DO NOT CARE FOR THEIR YOUNG ONES

The children know by now that mammals and most birds care for their young ones. A large number of animals of many different kinds do not care for their young ones. Some animals construct secure places for their eggs. They lay eggs there and then, do not pay any attention to the developing young ones. Such animals include reptiles (snakes, turtles, crocodiles, and lizards), fish, frogs, and insects and many more animals.

Conduct the following activities to show the children that many animals do not care for their young ones.

Field Observation

What sort of animals do not care for their young ones?

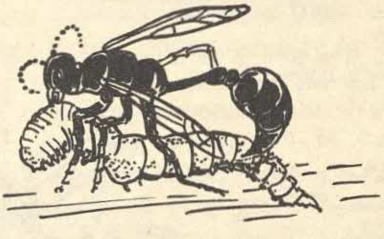
Recall the children's experience of insects like butterflies developing into adults without the care of their parents. Arrange a field trip. Help the children to collect a few eggs of insects and, if possible, either turtles or lizards. Instruct the children to keep the collections separately in small containers with holes to let in air. Encourage them to observe the collections regularly. Help them to release the young ones a few days after they hatch. The children can observe whether or not the young ones can find their food themselves and start their life without the care of their parents.

Field Observation

What arrangements do wasps make for their young ones?

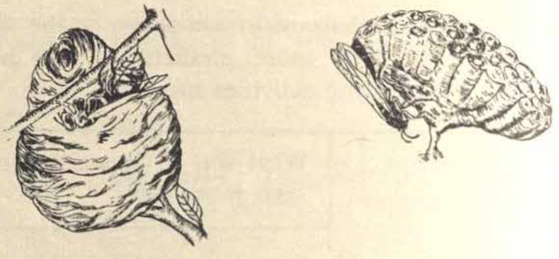
Encourage the children to observe wasps constructing nests with mud. Discuss with them the different types of wasps bringing different types of animals. The wasps put the prey inside the nests and seal them. Explain that the wasps seal their nests after laying eggs and the animals left inside the nests form the food of the young ones to be hatched out of the eggs. Help the children to observe the fully grown wasps breaking open the nests and flying out. Show the children the empty nests of wasps. See Fig. 9-30 a-c.

Fig. 9-30 a-c
Wasps bring different types of animals, like caterpillars, to be used as food.



(a) A wasp stinging a caterpillar.

(b) A wasp carrying a caterpillar to its nest.

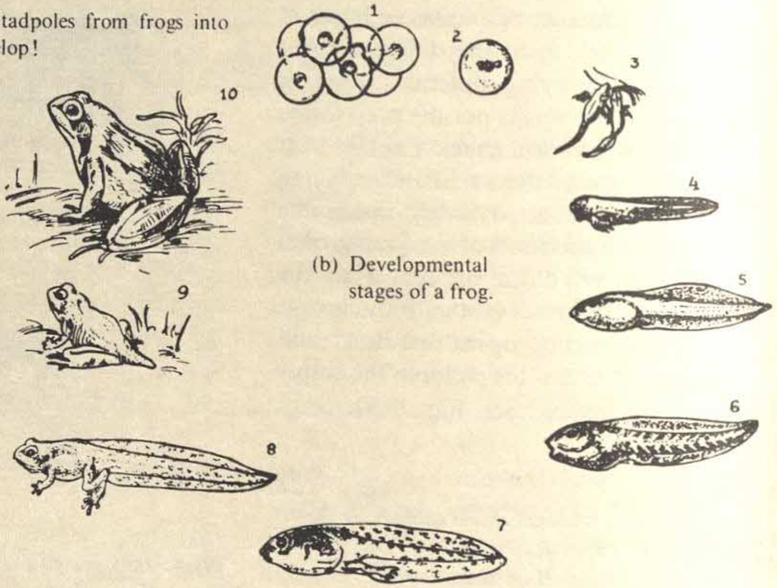


(c) Some nests of wasps.

Obtain eggs of frogs and of tortoises or turtles. Help the children to observe the development of frogs in a glass trough or an open vessel containing water. Help them to observe the hatching out of eggs of turtles or tortoises kept buried in sand inside a pot. Note the complete absence of care from the parents. See Fig. 9-31 *(a) and (b).*

(a) How different are tadpoles from frogs into which they later develop!

Fig. 9-31 a-b.



(b) Developmental stages of a frog.

For Better Understanding

Wasps build nests. They go in search of some small animals that will serve as food for the young wasps. Wasps select spiders and insect larvae (caterpillars). They do not kill these animals; instead they sting them repeatedly on certain points and thus make them incapable of any movement, although they are still alive. Then the animals are carried and put inside the chambers of the nests. Wasps then lay eggs on the bodies of these animals. The worm-like young ones (larvae) of wasps that come out of the eggs feed on the body of the animals. They grow into adult wasps inside the nest. The parents do not care for their young ones at all. When the wasps are fully formed inside the nests, they break open the chambers of the nests and fly away.

Reptiles are crawling creatures with scales or plates on their bodies. Most of them lay eggs. Their body temperature varies according to outside temperature. Turtles and tortoises are reptiles. The name *tortoise* refers to those found on land and in fresh water. Turtles are those found in sea water.

Scientists at Work

Some scientists study animal babies

Have you sometimes seen doctors who call themselves 'child specialists'? What does this mean? They are the doctors who have studied the various diseases of children. They also know the medicines that are effective in eradicating such diseases. These are the specialists interested in human babies.

You might be surprised to learn that there are scientists trying to collect more and more information about animal babies. You might wonder why they should bother to take up this task seriously. The information about animal babies is useful to us in many ways. Let us see how this is true.

Sometimes hunters get the young ones of some animals for zoos from forests. Unless we know the nature of their food and how they feed and how to help them feed, it will be very difficult to rear them.

Do you know that young fish are transported to different places in containers? These are released into ponds and tanks to grow into big fish. The people who are concerned with this industry collect information as to the time of the year during which these fish eggs are discharged into rivers. They find out the number of days required for these eggs to hatch, releasing the tiny fish. They gather information about the type of water in which these young ones live well, the types of food materials they eat, the possible enemies of these young ones in water, the temperature they can withstand, etc. These scientists also know how much air there should be in the containers while transporting and what sort of containers should be used. They know how many fish can remain in the containers and how long they can survive there. Unless they know about these things and make necessary arrangements, they are likely to find thousands of these young fish dying every day during the season.

The young ones of certain animals are harmful to our plants. For example, the young ones of many insects—insect larvae—infect our cultivated plants. The scientists try to find out their way of life so that they can plan the methods of killing them.

These are only a few examples which could be multiplied. The scientists who work with these young ones of animals contribute greatly to the welfare of our nation.

UNIT 9

ANIMAL LIFE

CLASS V

Overview

The children have learnt in classes I through IV about the diversity of animals and some aspects of their ways of life. They have also become familiar with the basic characteristics of animals as living organisms.

Here in class V, the children receive a very elementary idea about the environment of animals. This helps them to realize how the bodies of animals are adapted to their different surroundings. The land animals, for example, breathe atmospheric air into their lungs. The aquatic animals use gills to absorb the air dissolved in water. There are however some aquatic animals that have lungs. These periodically come to the surface to take in air and can remain under water for some time. These ideas add to the children's knowledge of the process of breathing. Breathing is characteristic of a living organism. Thus the study of breathing in animals will form a basis of understanding for the children to learn about respiration in higher classes.

One of the organs differently modified in different groups of animals is the *limb*. The mode of life of the animals is reflected in the nature of their limbs. The children's knowledge of the modifications of the limbs is organized in this class.

The fact that the structures of organisms are adapted to their environment and mode of life is not new to the children. They have observed and learnt about it in earlier classes. They learnt it while studying the food and feeding habits of animals and birds in the lower classes. The children have observed the food of animals, and the way they eat it. In this class, they will learn how the modifications of the various parts of an animal's body enable it to get the particular type of food it eats.

The children already know that the animals respond to stimuli. The children are helped to learn how certain birds and fishes respond to the change of seasons. This is introduced to the children through the remarkable phenomenon of migration in animals.

Thus in this class, the major ideas centre around two conceptual themes: (1) *adaptation* and (2) *response to stimuli*. The idea about adaptation of animals is the key to the understanding of the evolutionary process. Similarly, the idea of response to stimuli is fundamental to an understanding of the behaviour of animals. These two conceptual themes underlie some of the basic concepts of modern biology.

1. DIFFERENT KINDS OF ANIMALS ARE FOUND IN DIFFERENT TYPES OF SURROUNDINGS

Animals live on land, or on water, or beneath water. *Aquatic* animals are those that live in or on water. They all have some means of swimming in water. The animals that live on land are called *terrestrial* animals. Most of them have legs for movement on land. They have body covering for protection against sun, wind and cold. Different land animals have different ways of obtaining food and making their homes. Animals that spend part of their time in the air have wings. Some animals are capable of living both on land and in water. These have the combined features of land animals and water animals. Thus the features of animals are adapted to the type of environment in which they live and to their habits of living.

1(a). EACH TYPE OF ENVIRONMENT HAS MANY DIFFERENT KINDS OF ANIMALS

Animals are of different kinds. Animals whose body features have a resemblance are classified into groups. There are mammals, birds, reptiles, amphibians, fishes, insects, worms, etc. In each group, there are animals of different sizes. In each type of surrounding, there might be animals belonging to different groups. Thus on land there are mammals, birds, reptiles, amphibians, insects and worms. In the air, birds and mammals (bats) and insects are found. These are in the air only for part of the time. They must therefore be either terrestrial or aquatic.

1(a) (i). SOME ANIMALS LIVE ON LAND

A large variety of animals live on land. Many of them have legs to walk with. They have body coverings of various types to protect them against wind, rain, heat and cold. Carry out activities such as the following to enable the children to learn about the life of animals on land.

Discussion

What are the various types of movements of land animals?

Ask the children to mention the names of various land animals. Write them on the blackboard. Discuss their ways of movement on land. Help the children to classify the land animals as crawling, running, climbing, burrowing, and hopping animals. Use charts or pictures or actual animals to help the children to find out about the body parts of animals that enable them to crawl, run, burrow, etc. Impress them with the fact that land animals are not suited for life either in or on water. Many land animals are not capable of swimming in water or flying in the air.

Encourage the children to prepare a scrap book entitled 'How land animals protect themselves'. This is to be undertaken as a group project.

Encourage the children to read books on 'wild life', 'life of insects', 'life of reptiles', and 'life of mammals'.

1(a) (ii). SOME ANIMALS LIVE IN WATER

Many animals, both large and small, live in or on water. Water animals belong to different groups. All these animals have some arrangement for floating on or swimming in water. Animals that swim have smooth bodies. This enables them to swim easily. They have webbed feet or flippers or fins which act like paddles for swimming. Many water animals are able to breathe under water. They take the air (oxygen) dissolved in the water.

Help the children to conduct the following activities to enable them to understand better the life of aquatic animals.

Discussion

What organs help aquatic animals to move?

Ask the children to mention the names of aquatic animals known to them. Help them to find out the organs which help these animals in their movement in water. Make use of charts, pictures and actual animals or models for this purpose. Help the children to classify the aquatic animals and to know the group to which they belong.

Help the children to set up an aquarium and observe the life of different kinds of aquatic animals—fishes, snails, prawns and water insects.

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Collect information about the life of whales and discuss it with the children. Show how the limbs have been adapted as flippers. Help them to understand that whales give birth to young ones and the young ones suck milk from their mothers. Find out from the children the group to which whales belong.

For Better Understanding

Whales are the largest of the animals living today. Whales are not fishes. They are mammals. They breathe through their lungs and give birth to their young ones. These young ones suck milk from their mothers. Instead of legs they have paddle-like structures (flippers) that help them to swim. The hair on their body is very scarce. Some whales hunt other sea animals while some are herbivorous.

1(a) (iii). SOME ANIMALS LIVE ON LAND AND IN WATER

Frogs lay their eggs in water. The eggs develop into young ones called *tadpoles*. Tadpoles breathe by means of gills. They grow into frogs which have lungs. Frogs come out to the land in search of food. They get back into the water for protection. Frogs, toads, and salamanders are true amphibians; they spend the first part of their life in water, they move to the land as adults. Such animals are in the group called *amphibians*. Most of them must have a moist environment all their lives. There are many other animals like water snakes, crocodiles, turtles, tortoises, otters, and crabs that spend part of their time on land and part in water. None of these however are true amphibians.

If the following activities are conducted the children can understand this sub-concept better.

Discussion

How do certain animals live on land and in water?

Discuss with the children the fact that some animals live both on land and in water. Help them to understand the purpose of their going either into the water or coming out to the land. Help the children to find out the organs that enable the animals to live in water and those that help them to live on land.

Field Observation

What different kinds of animals live in water?

Take the children to a nearby pond. Help them to observe the pond teeming with animal life. Help them to observe the frogs, snails, insects, worms, etc. and to find out the animals that spend part of their time on land and the rest in water.

Encourage the children to make a collection of frogs' eggs and rear them in the classroom in a pot or a glass trough. See Fig. 9-31 *a, b.*

1(a) (iv). SOME ANIMALS LIVE ON THE LAND AND ALSO IN THE AIR

Many birds and insects come to the land for food, reproduction, and shelter. In times of danger, they escape into the air. They fly in search of food or to avoid unfavourable weather conditions.

Carry out the following activities to help the children to understand the animals that live on land and in the air.

Discussion **How is flight useful to birds?**

Help the children to recall their observations of birds frequenting the land for food, for building nests and for laying eggs. Discuss with them the usefulness of flight for birds. Draw their attention to eagles and vultures soaring high up in the air to scout for food materials below. Help them to understand that birds fly quickly from place to place in search of food or to avoid danger or to escape extreme, unfavourable weather conditions.

Help the children to find out the organs of animals that are useful while they are on the ground and those that enable them to fly in the air.

1(b). DIFFERENT ANIMALS HAVE DIFFERENT FOOD HABITS AND DIFFERENT TYPES OF HOMES

The children are aware that animals differ in their food habits. The nature of the mouth and teeth in mammals, the kind of beaks and feet in birds, reveal very well the food habits of these animals. In general, the mouth of any animal is adapted for the type of food it eats. Certain other parts of the body might be modified so as to help in the process of procuring food. Thus the butterflies have long tubular mouth parts to suck honey. The grasshopper which is also an insect has cutting mouth parts for biting and chewing grasses or leaves. The homes of animals also differ. Beehives, wasps' nests, insect galls, termite hills, rat burrows, and bird nests, are examples of some homes of animals.

Carry out the following activities to help the children to learn effectively that food habits and homes of animals differ.

Discussion **What are the food habits of some common animals?**

Ask the children to list the types of food eaten by different animals. Help them to classify animals according to their food habits. Point out that a given food habit may be followed by animals belonging to different groups. Help them to understand that the habits of animals reflect the broad nature of their food.

Class Project

Let us collect animal homes

Materials required
specimens or models of homes of animals
cardboard

Encourage the children to collect or to make models of the homes of different types of animals, and arrange to exhibit them in the classroom. Help the children to label the homes and write a short interesting account about each one of the homes.

Help the children to paint or draw the homes of animals, like bird nests, beehives, termite hills, spider webs, wasps' nests, etc.

Help the children to prepare an album entitled 'Homes of Animals'. Pictures cut from old magazines and paintings can be included in the album to make it more instructive and attractive.

2. DIFFERENT KINDS OF ANIMALS HAVE DIFFERENT TYPES OF LIMBS

The limbs of animals are useful to them in many ways. They are most useful to animals for procuring food, for moving about, for protection against enemies, and for building homes. The limbs of animals are of many different types. These are modified according to the way the animal moves: swimming, flying, running, crawling, hopping, climbing, or burrowing. The sub-concepts which follow can help to make this clear to the children.

2(a). MAN USES THE FRONT LIMBS (HANDS) FOR VARIOUS KINDS OF WORK

Man is more highly developed than any other animal. He devises means to adapt nature to his needs and to adapt himself to nature's requirements.

Man has four limbs. Animals like cows, horses, pigs, and tigers also have four limbs — all of them are legs. They use their legs in very limited ways like running, kicking, capturing prey, etc. In man, the front limbs are highly modified. They can be used for various kinds of work. They can use tools to perform numerous tasks.

Conduct the following activities to help the children to understand this sub-concept.

Observation

How are the limbs of man different from those of other animals?

Help the children to observe the legs of animals like horses, cows, dogs, and squirrels. Discuss the main differences between the limbs of these animals with those of man. Help them to find out the differences between the fore-limbs and hind-limbs of man. Discuss the uses of fore-limbs in performing various kinds of work. Impress upon the children the nature of our fingers, the thumb, and the coordination of fingers and thumb. Ask them to name the animals in which the fore-limbs are useful in doing work like catching, holding, etc.

2(b). MONKEYS AND SOME OTHER ANIMALS CAN USE THE FRONT LIMBS AS HANDS

Monkeys are highly developed animals although not nearly so much as man. There are many kinds of monkeys. In all monkeys the fore-limbs are somewhat similar to those of man. Monkeys also make use of their fore-limbs for doing various kinds of work like procuring food, catching, and holding. See Fig. 9-32.

Perform the activities mentioned below to help the children to learn that monkeys use the fore-limbs for many kinds of activities.

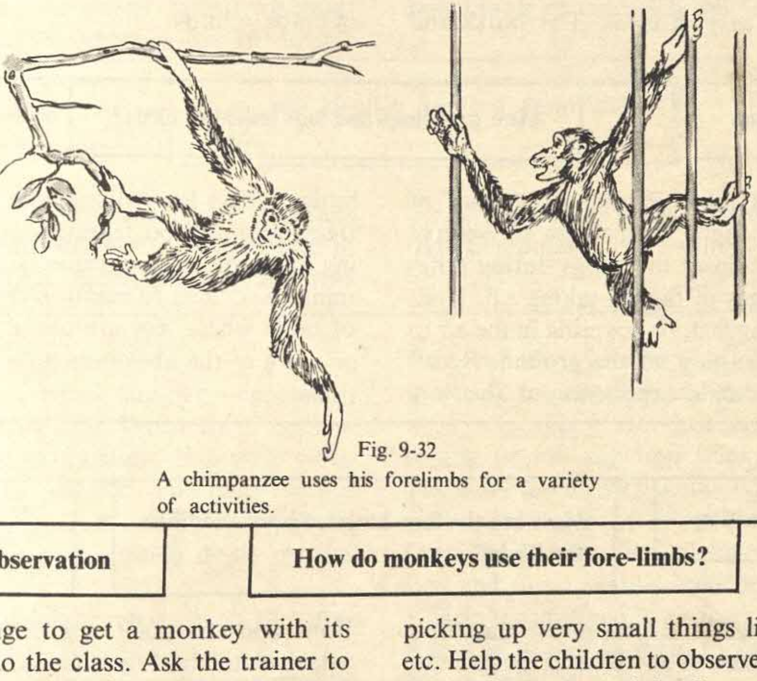


Fig. 9-32

A chimpanzee uses his forelimbs for a variety of activities.

Field Observation

How do monkeys use their fore-limbs?

Arrange to get a monkey with its trainer to the class. Ask the trainer to make the monkey perform various kinds of activities like accepting food, eating, holding sticks, catching objects, picking up very small things like lice, etc. Help the children to observe closely the manipulation of the fingers in the performance of various kinds of work.

Help the children to see the skeletons of the fore-limbs of animals *like cows, dogs, and man. Help the children to understand the structure of fingers of the fore-limbs that enable man to perform various activities with his hands and also to use tools.*

2(c). SOME BIRDS CAN MOVE ON LAND, SWIM IN WATER AND FLY IN THE AIR

In birds the fore-limbs are modified into wings. The wings are used for flight. The legs are useful to walk on land. The children have seen that in some animals the fore-limbs are useful for performing various kinds of activities. The fore-limbs are modified into wings in the case of birds. The beaks and legs are used for procuring food, holding, catching, attacking enemies, and making nests and carrying food to young ones. The habits of birds are different. Therefore, the beaks and legs are differently modified in different birds.

Perform the following activities to enable the children to learn about the modification of limbs in birds.

Discussion

How are wings and legs useful to birds?

Recall the children's experience of birds in flight. Help them to observe the position of the wings during different stages of flight—taking off, landing, flying fast, or hovering in the air to find something on the ground. Recall the children's experience of the way birds use legs for walking, perching on trees, holding food, tearing food, catching food, attacking enemies, and swimming. Ask them to mention the names of birds whose legs are useful for one or more of the above mentioned functions.

Demonstration

How are the fore-limbs of birds modified for flight?

Materials required
skeletons of birds and other animals

Arrange to exhibit in the classroom the skeleton of any bird. If the skeleton is not available in the school, it can be obtained from a nearby high school. Or, the children could be taken to a nearby museum or the museum section of a nearby school, college, or university. Help the children to observe the general nature of birds' limbs and their positions and the points where they are attached to the body. Guide them in comparing the limbs of birds with those of other animals like rats, rabbits, man, frogs and turtles. Help the children to learn that the general plan of the limbs is the same in all these animals. The limbs are modified to suit different functions.

2(d). REPTILES MAY OR MAY NOT POSSESS LIMBS, BUT ALL OF THEM CAN CRAWL ALONG THE GROUND

The reptiles of today include lizards, turtles, crocodiles, and snakes. All these animals crawl along the ground. The limbs of these animals are short. The body is not supported by the legs as in animals like cows, horses, cats, dogs, elephants, etc. Occasionally, reptiles raise their bodies above the ground and support themselves by their legs. Snakes have no limbs.

Perform the following activities to enable the children to better understand the above sub-concept.

Field Observation | **How do reptiles move?**

Help the children to watch the movements of animals like calotes, tortoises and snakes. Recall the children's earlier observation of lizards walking on walls and upside down on roofs. Discuss the reason why and how lizards can move in this way.

Investigation | **Can we identify reptiles from their trails?**

Guide the children to see the trails of animals, with particular reference to reptiles like calotes, snakes, and tortoises. Encourage them to identify the trails of reptiles.

For Better Understanding

Lizards have small cup-like depressions on the under surface. When these depressions are pressed against the walls they produce a partial vacuum. This modification keeps the animal from falling down when it walks vertically or upside down on the ceiling.

2(e). INSECTS WALK ON LEGS; MANY OF THEM ALSO HAVE WINGS TO FLY

Insects are six-legged animals. Some of them can fly with the help of their wings. Insects like butterflies and moths have very weak legs. They use their legs mostly for resting or for alighting briefly on objects. There are insects like beetles which can walk well on the ground in addition to flying. Certain insects like silverfish, bed-bugs, lice, and some termites have no wings.

Help the children to perform the following activities to enable them to understand the nature of limbs in insects.

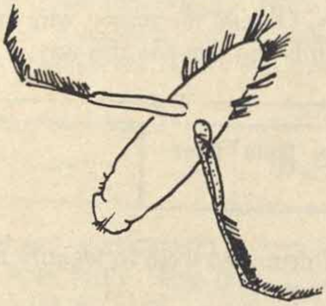
Field Observation | **What organs do insects use to move about?**

Help the children to observe how insects move about. Butterflies, silverfish, bed-bugs, mosquitoes, beetles, bees, lice, cockroaches, dragon-flies, house-flies, etc., may be observed. Collect some of these insects and show the children the structure of their legs. Note that the butterflies use legs for walking and for alighting and resting.

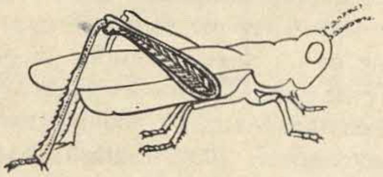
Field Observation

How are limbs modified in certain insects?

Fig. 9-33 a-c
In insects limbs are modified in various ways to perform different functions.



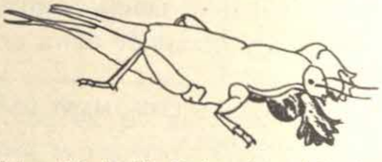
(a) 'Waterboatman' with limbs like an oar for swimming in water.



(b) Grasshopper, with limbs for hopping.

Assign an observation task to children. Ask them to find out and report to the class as to which of the insects have the following kinds of limbs :

(i) Insects with limbs that help them to hop about.
(ii) Insects whose fore-limbs help them to catch hold of some object.
(iii) Insects whose limbs enable them to roll a ball of dung.
(iv) Insects whose fore-limbs enable them to dig in the soil.
(v) Insects whose limbs help them to carry soil to build nests.
(vi) Insects whose limbs help them to swim in or on the water when they are adults. See Fig. 9-33 a-c.



(c) 'Mole cricket' with limbs adapted for burrowing in soil.

2(f). FISH USE FINS FOR SWIMMING

Fish have no limbs like those of other common animals. They have fins that help them in swimming. The number of fins differs in different fishes.

Help the children to conduct the following activities to learn that the fins help the fish in locomotion.

Field Observation

How are fins used by the fish?

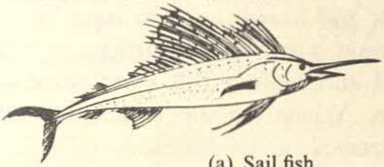
Help the children to observe the swimming of fish in an aquarium. Ask them to observe carefully how different fins move during different types of movements.

Demonstration

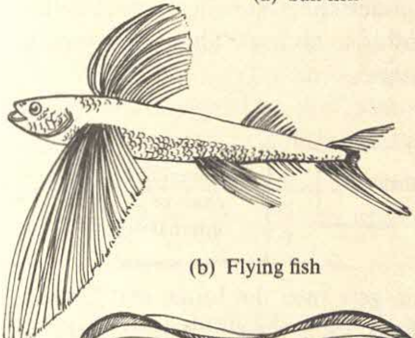
How many different kinds of fins are found in fish?

Collect different types of fish from the market. Spread out and pin the fins on boards. Help the children to see the different types of fins in fishes. Show the children eels and flying fishes, or pictures of those animals. Point out the absence of side-fins in eels. Spread out the fins of flying fish and explain that the fins help the fish in gliding through the air. See Fig. 9-34 a-e.

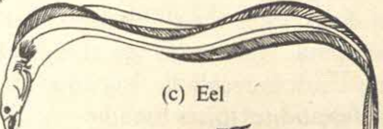
Fig. 9-34 a-e
Modifications of fins in fishes.



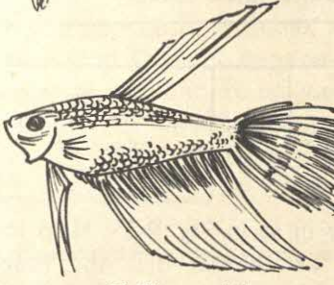
(a) Sail fish



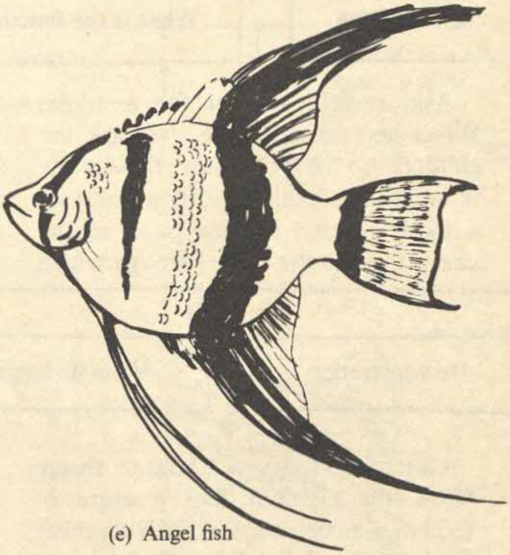
(b) Flying fish



(c) Eel



(d) Siamese fighter



(e) Angel fish

For Better Understanding

Eels resemble snakes in their general external appearance. But eels are fish. They breathe through gills. Snakes are reptiles and breathe through lungs.

3. ANIMALS BREATHE IN DIFFERENT WAYS

Oxygen is very essential for the life of organisms. In many animals oxygen gets into the body through breathing. Different animals have different kinds of organs of breathing. These are lungs, gills, or air tubes. Since the organs of breathing are different, the ways of breathing also differ in different animals.

3(a). MANY ANIMALS BREATHE THROUGH LUNGS

All mammals including man, and aquatic mammals like whales, breathe through their lungs. The same is true of all birds and reptiles, and of amphibians in their adult stage. Air containing oxygen is taken in through the nose into the lungs. In the lungs the oxygen is absorbed into the blood. The impure blood gives up carbon dioxide which goes into the lungs. This exchange of oxygen and carbon dioxide to and from the blood takes place through the very thin lining of the lungs. Carbon dioxide is expelled along with the remaining air through the nose. Birds and lizards are also lung breathers.

Lungs are bag-like structures. They expand and became full when there is air in them. When the air is let out, they get contracted.

Conduct the following activities to help the children to learn about the function of the lungs.

Investigation

What is the function of lungs?

Materials required
chart or model of internal organs of man

Ask a child to run for a while. When he returns to the class ask the children to observe how rapidly he is breathing. Exhibit either a chart or a model of the various parts of the chest. Discuss the route through which the air gets into the lungs and comes out. Encourage the children to observe an animal, preferably on a hot day. Help them to recall the way cows, dogs, calotes and tortoises breathe.

Demonstration

What do lungs look like?

Materials required
lungs of a goat
rubber tube
air pump

Obtain the lungs of a goat or sheep. Show the children the structure of the lungs as two bags. Attach a rubber tube to the windpipe and blow or pump air in as in Fig. 9-35. Help the children to observe that the lungs contract after the air goes out.

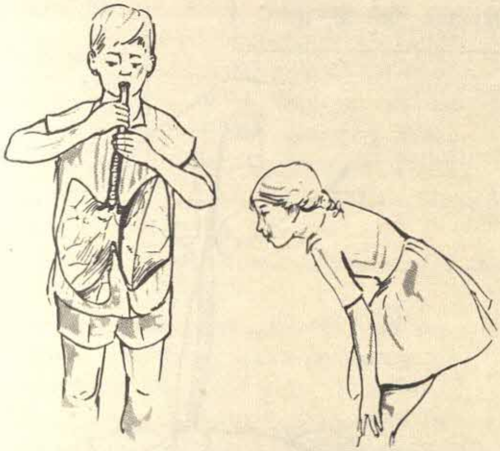


Fig. 9-35
A lung can be inflated by blowing in air; it collapses as the air goes out.

3(b). FISH BREATHE THROUGH GILLS

Oxygen is essential for all animals. Animals like mammals, birds, reptiles, etc., obtain oxygen from the air which they breathe. Water has oxygen dissolved in it. Fish take in the dissolved oxygen from water. They have special organs which can take in the dissolved oxygen. These organs are called *gills*. Gills are present in all fishes, and also in many other aquatic animals such as molluscs and crabs.

Conduct the following activities to help the children to learn about the breathing mechanism in fish.

Class Project

How do fish breathe?

Materials required
aquarium tank
fish (live)
ink (a few drops)

Help the children to set up an aquarium. Encourage them to observe a fish which is motionless in water. Let them see the fish opening and closing its mouth. Introduce a drop of ink just in front of its mouth. Show the children how the coloured water gets into the mouth and comes out through the gill slit. See Fig. 9-36.

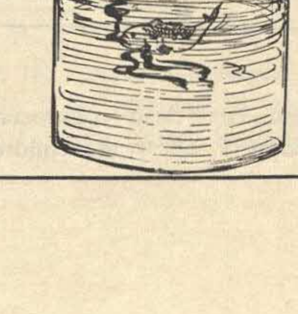


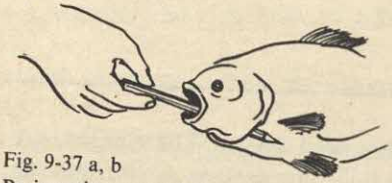
Fig. 9-36
A fish breathes by allowing water to pass through the gill slits.

Teacher Demonstration

Where are the gills in fish?

Materials required
fish
display board
pencil
pins

Obtain a fish from the market. Pass a pencil through its mouth and show it coming out through the gill slit. Lift the gill cover and point out the red gills. Explain that the gills take up the oxygen present in water, and transfer it to the blood. It is the blood in the gills which makes them red. See Fig. 9-37 a, b.



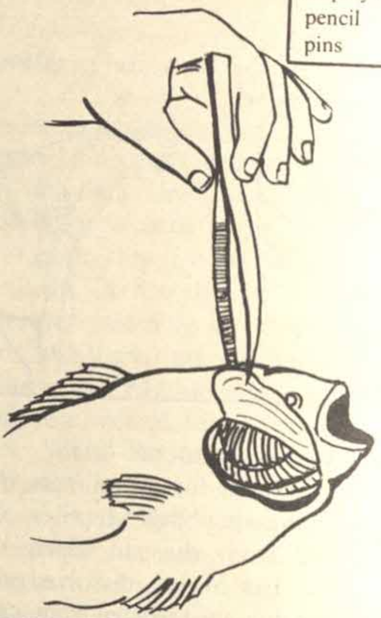


Fig. 9-37 a, b
By inserting a pencil it can be shown that in fish the mouth and gill openings are directly connected.

Ask the children to find out what other animals also breathe with gills. Help them to collect some tadpoles. Show them the gills.

3(c). INSECTS BREATHE THROUGH AIR TUBES IN THEIR BODIES

Common insects like butterflies, cockroaches and grasshoppers have neither lungs nor gills. They breathe through small openings in the body. These openings lead into minute tubes inside the body. These are the air tubes. Air is taken in and given out through these tubes. Oxygen and carbon dioxide are exchanged to and from the blood through the thin linings of these tubes.

Use the activities suggested below to help the students to learn about these breathing organs of insects—the air tubes in their bodies.

Investigation

What are the breathing organs in insects?

Materials required
insects
dissection board
scissors
pins
mounting needles
dissection tray

Obtain two dead cockroaches or grasshoppers. Show the children the presence of small openings on the body. Pin one of the cockroaches on the board. Cut along the sides of the body with scissors. With forceps lift up one part of the body covering. Place the dissected animal under water. Point out to the children the presence of a large number of white tube-like structures. Tell them that these are the air tubes. Use a hand-lens, if available, to magnify the view of the air tubes.

4. CERTAIN MECHANISMS HELP ANIMALS TO PROCURE THEIR FOOD

Different animals have different food patterns. They also have different means of obtaining food. The body parts of different animals are adapted to the food they eat and to their ways of eating. The sub-concepts which follow are intended to make this clear to the children.

4(a). BUTTERFLIES HAVE A LONG MOUTH-TUBE

Butterflies feed on the nectar of flowers. Nectar is often found at the bottom of the flower. Insects like bees are small and can fold their wings. They are therefore able to reach the bottom to suck the nectar. Butterflies have large wings and cannot reach the bottom of the flowers. They have a long mouth-tube. This mouth-tube is kept coiled like a watch spring. After alighting on a flower, the tube is uncoiled and pushed to the bottom of the flower and the nectar is sucked up.

Help the children through the following activities to understand the way in which butterflies obtain nectar from flowers.

Field Observation

Why do insects visit flowers?

Encourage the children to observe butterflies visiting flowers. Let the children observe them going from flower to flower. Discuss the purpose of such visits. Ask the children to mention names of insects that go to flowers for nectar. Help the children to watch many small insects getting to the base of flowers. Point out that the large wings of the butterflies prevent them from going to the base of the flowers.

Demonstration

What are the mouth parts of butterflies like?

Obtain a live butterfly. Demonstrate to the children the nature of its mouth-tube. Uncoil the tube and show its length. Release it and show how the tube rewinds.

After the demonstration release the butterfly. Take care not to injure or torture it during the demonstration.

Collect different types of insects like dragon-flies, grasshoppers, butterflies, ants, and beetles. Show the children the nature of the mouth of these insects and how it is adapted to the types of food they eat.

Do not select insects like bees or wasps for this purpose. They may sting. The stings of these insects are very painful.

4(b). FROGS HAVE STICKY TONGUES

The food of frogs consists of insects and worms. A frog makes use of its tongue to capture its prey. A frog's tongue is long. This helps the animal to catch the prey from a distance. The tongue is sticky and any small object which touches it tends to stick there. The tongue is fixed in front and free at the back. When a frog sees an insect, it shoots out its tongue. The insect sticks to the tongue. Then the tongue and the captured insect are drawn back into the mouth. The frog captures the insect in a quick movement which is completed in a fraction of a second.

Perform the following activities to enable the children to learn about the frog's mechanism for procuring food.

Field Observation

How do frogs catch their food?

Encourage the children to observe frogs feeding on insects. Show them the pictures of a frog catching an insect. Use a picture to point out the position of the tongue during the different stages of capturing the insect. Discuss the structure of the tongue in a frog as adapted to capture small animals. See Fig. 9-38.

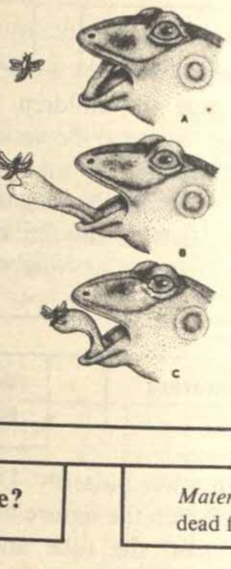


Fig. 9-38
The structure of the tongue in a frog is adapted to capturing small animals.

Demonstration

What is a frog's tongue like?

Material required
dead frog

Bring a dead frog to the class. Open its mouth and show the children the tongue in its normal position. Pull the tongue out of the frog's mouth. Show the tongue fixed in front and free at the back. Let some children touch the tongue and feel its sticky nature. See Fig. 9-39.

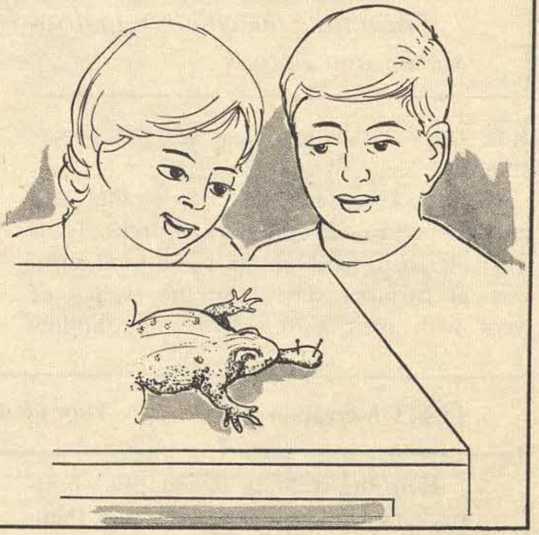


Fig. 9-39
A frog's tongue is fixed in front and free at the back.

4(c). SOME WATER BIRDS HAVE LONG LEGS AND LONG BEAKS

Some birds like storks, cranes, and herons feed on insects, worms, fish, and frogs. These are found in ponds, along the edges of rivers, and in open fields. Compared to the other birds of their size, these birds have very long legs. Their beaks are also long. The long legs help these birds to stand in the water and keep the body dry. The long beaks permit them to pick up small animals from the water.

Conduct the following activities to help the children to learn how long legs and beaks are useful to water birds.

Field Observation

How are long legs and beaks useful to water birds?

Encourage the children to watch storks, cranes, and other water birds standing in the water for a long time to obtain food. Help them through discussions to understand the use of their long legs and beaks.

Class Project

Let us make models of water birds

Materials required
plasticine
specimens or pictures of water birds

Help the children to prepare plasticine models of water birds like cranes and storks. Ask them to notice the long legs and beaks. In the absence of real specimens, provide them with photographs or pictures of these birds as guides in their work.

Encourage the children to draw figures of water birds like cranes, storks and herons.

4(d). THE WOODPECKER HAS A STRONG, POINTED BEAK

Woodpeckers feed on insects that are mostly found under the bark of trees. Their legs help them to climb trees and to cling to vertical surfaces. They tap the trunks of trees with their beaks. From the hollow sound they locate the presence of insects under the bark. With the help of their strong pointed beaks, they drill holes into the bark. Then they insert their tongue and catch the insects. Through the following activities help the children to learn how woodpeckers are adapted to their food habits.

Field Observation

How do woodpeckers get their food ?

Help the children to identify woodpeckers. Children can easily spot them from the way they climb trees. Encourage the children to listen for the tapping sound made by these birds on tree trunks. Ask the children to observe how they drill holes in the bark of trees and catch insects.

Either obtain a stuffed specimen from a nearby high school or college museum, or take the children there. Show them the beaks and feet.

Encourage the children to draw the pictures of woodpeckers either from life, or from stuffed specimens, or from pictures. Help them to note the colour of their feathers, the nature of their beaks and legs. Use colour drawings, if possible.

4(e). THE EAGLE HAS STRONG SHARP CLAWS

Eagles are carnivorous birds. Carnivorous birds are those that feed on other animals. Eagles soar high up in the sky and search for food on the ground. When they spot things like rats, or young birds, they swoop down at great speed and carry the prey with their feet. The feet have strong curved talons which help them to kill and hold the captured animal.

Use some of the following activities to help the children to realize that the legs with their claws enable the eagle to catch and carry its prey.

Field Observation

How do eagles' feet help them to get food?

Recall the children's experience of eagles swooping down and carrying off small animals like mice or chicks of birds. Show the children pictures of eagles carrying small animals in their talons. Contrast this habit with that of crows and other birds that carry such animals in their beaks. Discuss the nature of the feet of eagles—strong legs with sharp, curved talons to hold the prey. See Fig. 9-40.

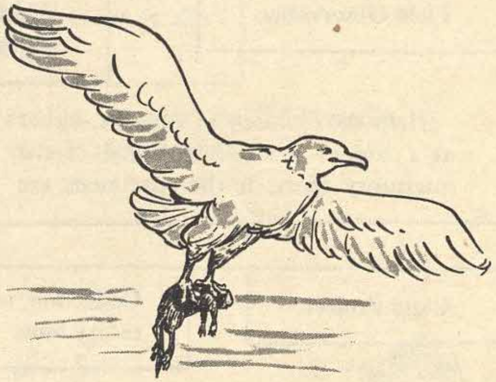


Fig. 9-40
An eagle has strong legs with sharp, curved talons to hold the prey.

Invite the children either to visit a zoo or museum or the museum section of a nearby higher secondary school or college. Help them to see the feet of birds like eagles, kites, etc. Discuss the way those are used for killing and carrying small animals.

5. SOME BIRDS MIGRATE LONG DISTANCES

Many animals move from one place to another when the conditions become unfavourable for them. Thus, when forests were cut down to clear land for farming, some animals moved to other places. This sort of movement of animals is not termed migration in the real sense of the term. *Migration* refers to the periodical movement of animals from one place to another and their return to the same place. The most noted among the migrating animals are birds. There are certain birds that have fascinating migratory habits.

5(a). BIRDS AVOID UNFAVOURABLE WEATHER CONDITIONS BY MIGRATION

The children see the common birds such as sparrows, kites, and pigeons as resident birds. But there are some birds that appear only during a particular season. The wagtail and wild ducks come to the plains only in winter. Their summer home is in the Himalayas and as far as Central Asia. They leave those places before the winter sets in, and stay in the swamps and fields of India during the winter. Then with the onset of summer they go back to their original home.

Children can be helped to understand the migration of birds by undertaking the following activities.

Field Observation

Which are some of the well-known migratory birds?

Help the children to observe, either in a zoo or a museum, some of the migratory birds. If the specimens are not available, the children can be shown pictures of some migratory birds and told the facts about them.

Class Project

Collection of information about migratory birds

Help the children to read and collect information from books regarding the well-known migratory birds. Let the children plot the routes taken by such birds, and estimate the distance covered by each type.

Draw the children's attention to flocks of ducks or geese flying high in the sky. They come from the north as winter approaches, and leave again before the weather gets hot.

5(b). CERTAIN BIRDS FIND SUITABLE NESTING PLACES BY MIGRATION

Migratory birds spend their time in two places each year. In one of the places they build their nests and breed. Their young ones need plenty of food for their growth. Food materials in plenty should be available in the surroundings. When the weather gets cold, and the food scarce, the birds migrate to the south.

Conduct the activities mentioned below to help the children to understand how birds find suitable nesting places by migration.

Discussion

Where do our wild ducks spend the summer?

Discuss the reasons why birds migrate. Recall the children's observation of wild ducks arriving during the winter. If the children are not familiar with wild ducks, take them to the nearby lakes and ponds and show them the wild ducks. Point out that these ducks breed in Central Asia, Europe, or in the Arctic regions.

Interview

What migratory birds are found in the local bird sanctuaries?

Encourage the children to visit a nearby bird sanctuary at different times of the year. With the help of the local experts, acquaint the children with the various migratory birds.

For Better Understanding

The distance covered during migration might range from a few hundred to a few thousand kilometres. Birds migrate periodically in order to escape the intense cold of winter or the dry heat of summer. They breed during the summer in a cool place. During winter food becomes scarce and the weather becomes cold. Then the birds go to other places where food is available and the weather is less severe.

Some scientists use a special technique to study migration. The birds are caught by putting loops of fine horsehair on the ground. Then a light aluminium ring is put around one leg of each bird and the birds are released. This ring bears an address and a number on it. If anyone ever finds the bird, the report is communicated. Thus information is collected and scientists learn more about the migrating habits of birds. See Fig. 9-41.

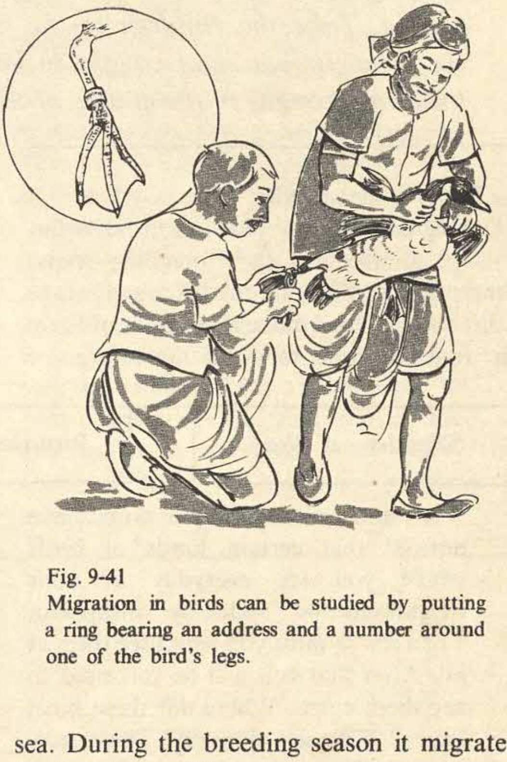


Fig. 9-41
Migration in birds can be studied by putting a ring bearing an address and a number around one of the bird's legs.

5(c). SOME FISH MIGRATE LONG DISTANCES

Eels are fish which are snake-like in appearance. These are known for their migratory character. The adult eels live in fresh water. They migrate into the sea to lay eggs. There the young ones hatch out of the eggs. They grow in the sea and later return to the rivers.

The Indian shad is a fish which lives in the sea. During the breeding season it migrates to the rivers. After the breeding season it returns to the sea.

Carry out the following activities to help the children to learn about the migration of fishes.

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Demonstration

What are some of the migratory fish found in India?

Obtain specimens of an eel and an Indian shad from the market. If the specimens are not easily available, take the children on a trip to the nearest museum. Show them these fishes. Explain the migratory habit of these fishes. Tell the children the purpose of their migration.

If there is any big river nearby, find out where the Indian shad is caught. Take the children to the fishing bank of the river. Show them the Indian shad caught in large numbers. Explain that the fishes are caught in the course of their migration.

For Better Understanding

During the migratory season, fishes swim in large numbers to their breeding spots. Fishermen would like to take advantage of this situation and make huge hauls of these fish. It is not wise to catch the migratory fish that go for breeding. If such breeding fish are caught, the future stock of fish will be depleted. Therefore, certain regulations prohibiting the catching of such fish are enforced. People violating such regulations are punished.

Scientists at Work

Bird-ringing is a special science

If you are observant, you might have noticed that certain kinds of birds which you see everyday in your neighbourhood suddenly disappear. For a few months you won't see them at all. After that you will be surprised to see them again. Where did these birds move? Why did they go? These questions might puzzle you. Scientists usually try to solve such puzzles. There is a group of scientists who constantly seek to solve the mystery of periodical appearance and disappearance of birds. They are called *bird watchers*.

The general interest of these bird watchers is to study the life of birds. Such persons organize themselves into societies. Most of the countries today have bird watchers' societies. The members of such societies observe the different kinds of birds and their behaviour. They periodically publish some information about the birds of their locality in their newsletters or journals. One morning they might have noticed that a particular kind of bird has disappeared from their locality. They make a note of this in their newsletter. To their great surprise, they might find that the same kind of bird has reappeared in another country where it was not found during certain months. Putting these observations together, they think that perhaps the birds which left this country have gone to the other country. But how could one *prove* that the birds which left one country went to another ?

To solve this problem, they catch birds suspected of migration. The catching of these birds is done by special types of nets that will not injure the birds. They put light metal (aluminium) or plastic rings on their legs. These rings contain some vital information about when and where the bird was ringed and the address of the person who ringed it. It also carries a request to send information about the place in which it is caught and the date, etc., if anybody happens to catch it. Large numbers of such ringed birds are released every year. This system of research is called *bird-ringing*.

The data thus collected are analysed. The scientists draw conclusions about the total distances travelled by the birds, the speed of the flight, and so on. Such a study of bird migration has proved useful in the medical field. How can this be?

Some of the birds coming from a particular country bring with them certain diseases. These diseases are found to be caused by very minute organisms called virus. These virus are found on the lice that are sucking the blood of these migrating birds. Thus a particular kind of bird might carry the virus from one country to another. Epidemics might break out in the country and many lives might be lost. Scientists, by collecting such information, are able to take all precautions to check the outbreak or the spread of diseases.

Bird-ringing is a very interesting activity. Many people who do bird-ringing regard it more as a hobby than anything else. But you have seen that it is also a useful science. Bird-ringers seek explanations for the changes in bird populations that they see. In this process, these scientists learn much about the habits of birds, and gather other highly useful information as well.

UNIT 10

HUMAN BODY, HEALTH AND HYGIENE

CLASS I

Overview

Education aims at the full development of a child. The growth of his body is as important as that of his mind. He has to be helped to develop habits that would later on make him a healthy and a happy adult. Unit 10 aims at developing some good health habits in children at class I level.

It is common knowledge that habits once acquired are difficult to modify. In the beginning it is as easy to learn to be clean as otherwise. However, unclean habits once acquired cannot be changed easily by informing children that habits of keeping clean are necessary for health. Hence, habits such as those of cleanliness (major concept 1), regular rest and sleep (major concept 2), and of regular exercise and recreation should be promoted in children from the earliest stage.

How can children be helped to develop these habits? One good way is through their tendency to imitate adults. Teachers and parents can set examples for children by keeping themselves clean. The surroundings of the school and home are kept neat and tidy, profitably involving children in this task. They develop in this way an attitude—a strong inclination towards cleanliness.

Children not only imitate, but they also inquire. For example, before *accepting* regular habits of rest, sleep, exercise and recreation, they desire to *understand* why these habits should be developed. Many sub-concepts under major concepts 2 and 3, use this logic to develop good habits in children (e.g. rest rebuilds the body, exercise makes the body strong, play ensures good sleep, and so on).

In order that a child may grow into a healthy person, a good pace of physical growth should be maintained from the beginning. Though the signs of physical growth (increase in weight, height, and girth) are so obvious, children may not be conscious of them. Major concept 5 concerns this idea. Records of height, weight, etc., may be maintained to highlight the importance of a proper rate of physical growth. With the help of children, cases of poor growth may be detected and corrected.

A body does not grow well by itself. It needs good food and other things for its healthy growth. Since these children are so young, it is not proper to go into details of the above ideas. Through discussion or anecdotes, children can be made aware of the need for air, water, food, etc., as given in the major concept 4.

1. HABITS OF CLEANLINESS ARE NECESSARY FOR HEALTH

One of the important steps to keep oneself healthy and free of disease is to keep oneself clean and free of dirt. Many diseases from which man suffers have their origin in dirt. The general standard of health in this country is not so good when compared to that prevailing in the more developed countries.

1(a). HABITS OF CLEANLINESS INCLUDE CLEANING OF HANDS, FACE, EYES, MOUTH, NOSE, TEETH; TAKING BATH, TRIMMING NAILS, COMBING HAIR AND WEARING CLEAN CLOTHES

The hands, eyes, nose, face, nails, hair and other parts of the body as well as one's clothes are exposed to air and dust particles. As a result, these parts of the body, and the clothes, become dirty. If one does not clean the hands and mouth before eating, the food one eats is contaminated or mixed with dirt and proves harmful to health. Similarly, the teeth must be cleaned before one takes the morning, noon and evening meals. One eats various types of foods. Small particles of the food substances get lodged in the teeth inside the mouth. After some time, these particles decay and produce substances which are harmful to the teeth and to the health in general. So the mouth and the teeth must be cleaned also after the food has been taken. Similarly, dirt accumulates under the nails and then passes with the food into the body. Thus, the nails should be kept clean in the interest of good health. One should also frequently take a bath and comb the hair. Clean clothes are not only pleasing to the eyes but also very hygienic. The eyes are the organs for sight and should be regularly washed with fresh, cool water. No dirty material should be allowed to accumulate around them as it may produce eye disease. It is, therefore, essential that the different parts of the body, and clothes, be kept quite clean. To help children understand the importance of cleanliness, the following activities may be conducted.

Demonstration

How can we keep nails clean?

Materials required
nail-cutter
soap solution

Hold a health-parade to see whether the nails of the children are well trimmed. Find out if any dirt has accumulated under some boys' nails. Help them understand how dirt affects health. Help children trim their nails with a nail-cutter or a scissors. A soap solution may be applied to the nails before trimming. Notice that the application of soap solution makes it easier to trim the nails.

Discussion

How should we clean the various parts of the body?

Discuss with children that dirt collects in various places of the body. Also tell them that sweat accumulates under the armpits and creates a bad odour.

These places and parts must be cleaned. To keep clean one has to take a bath. Let children understand that dirt and sweat are removed easily by the application of soap. The body should not be exposed to air for a long time when it is wet, and should be dried up soon. The towel helps to dry the body quickly and acts like a blotting-paper. If the towel is rough and the body is rubbed with it, the small pores in the body are cleaned. After bath, the bather can oil his hair and comb it. Then he can put on clean clothes, which make him feel comfortable.

Class Project

How should we clean our teeth and mouth?

Materials required
tooth powder
napkin

Encourage the children to arrange a health-parade at a time when they are having morning school. Let children ask each other to see if their friends in the class have cleaned their teeth and mouth this day. Let those children who have not cleaned their teeth get some tooth powder or *datun* and clean their teeth in the school. Show them the various types of tooth powders, tooth pastes and twigs used for cleaning teeth and the method of using them. Help the children to see the necessity of cleaning teeth. Let the children wash their mouths and dry them with small towels.

Help the children to make neem *twigs* (datun) *for cleaning teeth.*

Have the children wash their hands and mouth before and after meals.

Have the children form health committees to assess personal hygiene of classmates. See that all children keep their hair, face, mouth, teeth, nose, eyes, clothing, hands, feet, nails, etc., clean.

Encourage the children to participate in the health inspection after the morning assembly and before the start of regular lessons.

1(b). HABITS OF CLEANLINESS INCLUDE KEEPING THE CLASSROOM AND HOME CLEAN

The children spend a great deal of their time in classrooms and at home. Unless the classrooms and their houses are clean, it will not be possible for children to keep good health. Hence it is necessary for all to see that homes and classrooms are always clean. The following activities may be undertaken to help children to understand the importance of cleanliness in the classroom and at home.

Class Project **How can we keep the classroom clean?**

Materials required
broomstick
duster

Encourage the children to sweep the floor and walls of the classroom. Let them brush the furniture, picture frames, charts, maps and other articles and throw away the dust and dirt in the dust-bin. Ensure that they cover their mouths and noses with a handkerchief to avoid inhaling the dust.

Let the children see the various places in the classrooms or their homes where dust particles accumulate most.

Encourage the children to ask mothers at home to permit them to help in doing small jobs of cleaning, e.g., sweeping the floor, removing cobwebs from the corners of walls, etc.

For Better Understanding

Besides dust, organic matter from the skins of fruit and vegetable peelings also accumulates in the corners of classrooms or homes. There it decomposes and produces a foul smell. This decomposition helps in the growth of insects and germs. During sweeping or brushing, dust particles which have settled on the floor are disturbed. Being very light, they begin to float and move in the air. It is not good from the point of view of hygiene to inhale the air which contains such dust particles. It is often advisable to cover the nose while sweeping and brushing.

1(c). HABITS OF CLEANLINESS INCLUDE HAVING ONE'S OWN DRINKING VESSEL

While one is drinking water from a vessel, it gets contaminated by coming into contact with the hand and lips. If the same vessel is dipped into the stored water and used for drinking by another person, the contamination is passed on to the water in the storage vessel and to the person drinking it. From the hygienic point of view, therefore, such unclean habits should be avoided. Children can be helped to understand this better by performing the following activities.

Class Project **How should stored drinking water be used?**

Materials required
water pot
ladle

Encourage every child to bring his/her own drinking glass. Let them queue before a water pot and get drinking water into their glasses by a ladle. Let them understand that the right method of taking out the drinking water does not involve direct touching with hands.

Discussion

How can drinking vessels be kept clean?

Discuss with children methods of cleaning drinking vessels. Let them name the various materials they can use for cleaning vessels. Usually soil or clay is used for this purpose. It may not be hygienic to use clay, as it gets contaminated due to the presence of bacteria. It is also not available in cities. Ash from burnt coal is also used for cleaning utensils. Help children to understand that it acts as an abrasive in cleaning metallic utensils.

Help the children to understand that for hygienic reasons soap or some detergent powder like Vim is better than clay or soil for cleaning purposes.

1(d). HABITS OF CLEANLINESS INCLUDE COVERING THE MOUTH WHILE COUGHING OR SNEEZING

At the time of coughing and sneezing, air is forced out of the lungs through the mouth and nose. This air contains many particles of saliva and germs, which can spread communicable diseases. To avoid spreading infection, one must take care to cover the mouth and nose while coughing or sneezing.

A very good habit is to always have a handkerchief. Encourage this habit among children. Let them realize that it is unhygienic to use another's unclean handkerchief. Little children can be helped to understand it by undertaking activities such as the following.

Investigation

What happens when we cough or sneeze?

Encourage the children to bring their own handkerchiefs to school. Let them use it when they cough or sneeze, by covering their mouths and noses with these. After sneezing, let children see the drops of moisture that are accumulated on the handkerchief. They may see some dust particles on it. Encourage them to bring a fresh handkerchief each day.

Encourage the children to hold their cupped palm to the mouth, while sneezing or coughing, when they do not have handkerchiefs.

Show the children a picture of surgeons and nurses covering their mouths and noses with a piece of cloth in the operation theatre. Let them understand that this practice prevents the spread of disease germs from the breath or cough of doctors and nurses to the patient.

Arrange occasional inspection of handkerchiefs and advise children to clean their handkerchiefs at home.

1(e). HABITS OF CLEANLINESS INCLUDE AVOIDING SPITTING IN PUBLIC PLACES

Spit contains the excretions from the windpipe, the lungs and the mouth. The contents of the spit may contain disease-producing germs. When the spit gets dry these germs are dispersed in the air. So the spit helps in the spread of disease. To avoid this, therefore, one should not spit in public places. The following activities may be undertaken to help children to understand this.

Class Project

How can spitting be done hygienically?

Material required
spittoon

Provide a spittoon outside the classroom. Let children cultivate the habit of spitting in the spittoon when they must. Help them to understand that the spit collects inside the spittoon and hence is not so harmful to health. The spittoon should be cleaned and disinfected with lime every day.

Field Trip

At what public places are spittoons provided?

Let the children visit cinema halls, theatre halls, dispensaries, hospitals and bus or railway stations. Encourage them to observe that spittoons are provided in such public places. Discuss how the spreading of disease from spit could be prevented by such measures.

Advise the children not to turn the pages of a book by moistening their fingers with saliva and touching the pages.

Advise the children not to wipe their slates with saliva.

2. HABITS OF REST AND SLEEP ARE NECESSARY FOR HEALTH

The human body is somewhat like a machine. The various parts of the body perform their various functions systematically. If the different organs are required to work constantly, they will soon be tired. Tired parts will lose their efficiency and the whole system will soon break down. To avoid this, one should give rest to the working parts of the body. Similarly, the brain also needs rest. Rest can be obtained by sleep, when both physical and mental fatigue is removed.

2(a). REST REBUILDS THE BODY

The food that one eats provides for the development and growth of the body. It also provides energy for work. During work or even when one is at rest, energy is spent at the cost of the accumulated energy materials stored in the body. Such materials which are broken down through work, can only be rebuilt and refreshed through rest. With the following activities the children can be helped to understand this sub-concept.

Discussion | **What is the effect of rest on the body?**

Engage the class in a discussion on the effect of rest on the body. Ask such questions as 'Do you feel like taking rest after a two-hundred metre race?', 'How do you feel at the end of the day?', 'Do you feel refreshed in the morning when you wake up after a good sleep during the night?' The purpose of the discussion is to help children realize that they are talking about the effect of rest on the human body after some physical work. Help the children to understand that the body will be refreshed and rebuilt after sufficient rest.

Invite the attention of the children when they yawn. It means that either the body or the mind is overworked and needs rest.

Show the children how players rest in the field after a football game.

For Better Understanding

Muscles and other parts of the body literally wear out from normal use. In this way the body resembles a piece of complicated machinery. But there is a notable difference between the two in so far as recovery is concerned. The worn-out parts of a machine can only be replaced, but they cannot be repaired or rebuilt anew. But the worn-out parts of a human body can be rebuilt through growth of new cells and tissues. This occurs most effectively when the body is at rest.

2(b). REGULAR BEDTIME HABITS ARE NECESSARY FOR SUFFICIENT REST

Rest should be taken at regular intervals. Sound sleep is the best means of having rest. But the bedtime should be regular. The children can be helped to understand this idea by performing the following activities.

Discussion **Why are regular bedtime habits necessary?**

Discuss with the children the necessity of regular bedtime habits to provide sufficient rest. One's health becomes unsound if one does not have enough sleep. Point out to the children that there are some persons who suffer from insomnia as a result of irregular bedtime habits. Lead them to the conclusion that one must be regular in going to sleep and in getting out of bed.

Interview **What is your bedtime habit?**

Let the children have a talk with the village *chowkidar* or night watchman. The *chowkidar* keeps watch on the village at night. He will say that he cannot keep awake at night as well as during the day. He needs rest and if he keeps awake at night, he must sleep during the day.

Ask the children if they have been to a theatre or cinema show at night. They might have fallen asleep at the theatre itself and may not remember being carried to bed, while asleep, by their parents. The body needed rest; so they fell asleep in spite of the fact that the show was going on.

2(c). ABOUT TWELVE HOURS OF SLEEP IS NECESSARY FOR CHILDREN

The amount of sleep necessary for health, goes on decreasing with the advancement of age. A newly-born child is awake for less than four hours a day and asleep for the remaining period. But a mature person can hardly sleep for more than seven hours.

Class I children need to sleep for longer periods—about twelve hours a day. The children can be helped to understand this by performing the following activities.

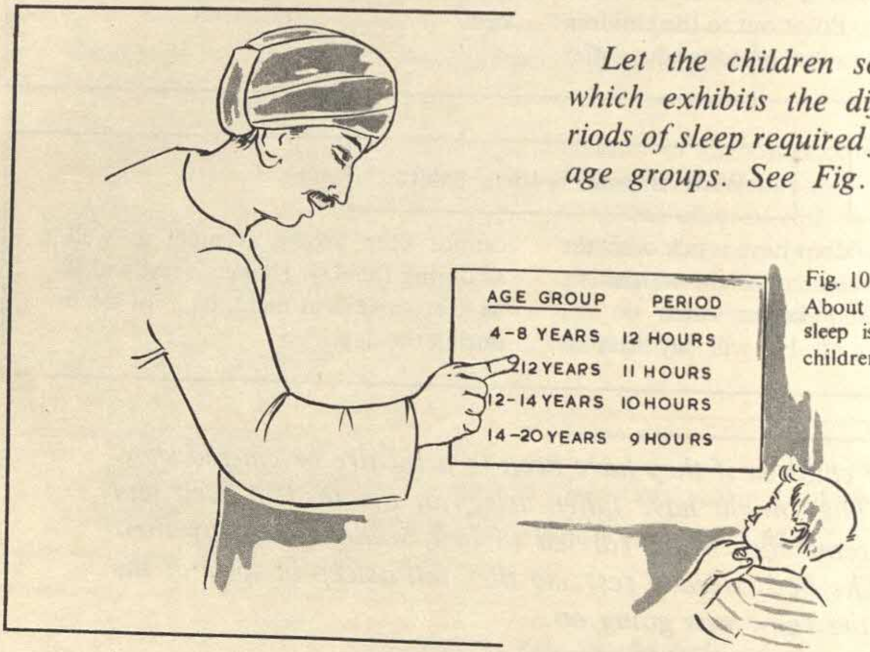
The young body of a child has to build and rebuild tissues many times. So, naturally it requires rest for a longer time. Adults no longer grow, and their physical activity is usually less than that of children. As a result, an adult requires rest for a shorter duration. The following activities will help the children to understand this idea.

Interview

How many hours of sleep do children need?

Let the children find out from their mothers about the hours of sleep small babies require. Let them also ask friends as to when they go to bed and when they wake up the next morning. Let the children ask their parents how many hours of sleep they enjoy. Lead them to the conclusion that children need about twelve hours of sleep.

Let the children see a chart which exhibits the different periods of sleep required for various age groups. See Fig. 10-1.



AGE GROUP	PERIOD
4-8 YEARS	12 HOURS
12 YEARS	11 HOURS
12-14 YEARS	10 HOURS
14-20 YEARS	9 HOURS

Fig. 10-1
About twelve hours of sleep is necessary for children.

3. HABITS OF EXERCISE AND RECREATION ARE NECESSARY FOR HEALTH

Habits of exercise are necessary for health as they help in building up various tissues of the body. Exercise helps in the growth of the child's muscles and bones and makes the body strong. It also ensures a good appetite and sound sleep. Besides exercise, recreation is also needed for health as it helps in physical and mental relaxation.

3(a). EXERCISE MAKES THE BODY STRONG

Exercise makes the body strong. The students can be helped to realize this fact by undertaking the following activities.

Discussion — **What is the effect of exercise on the body?**

Invite the children to identify pupils who do not take regular exercise. Let them also see other boys or girls who take regular exercise. Point out the difference in the physique of the two groups of children. Lead them to the conclusion that this strongly suggests that exercise makes the body strong.

Field Trip — **What makes the body strong?**

Invite the children to visit a village *akhara* or gymnasium where young men take exercise and do wrestling for building up the body. Let the children understand how athletes or gymnasts develop their bodies through exercise. Compare their physique with that of an office assistant or painter who has not much physical exercise to do.

Let the pupils see three charts showing a weak body, a boy taking suitable exercise and a boy who has become strong after regular exercises.

3(b). RECREATION MAKES THE MIND FEEL FRESH

Recreation provides opportunities to an individual for relaxation and amusement. Seeing a circus or a play or listening to film music satisfies the mind. One forgets all worries during recreation. After it, one again feels fresh and fine. Recreation is of various types. As the same kind of recreation would not be suitable to all ages, one must choose the recreation suited to his own age-group. With the following activities, the children may be helped to understand the concept better.

Discussion — **Does recreation make us feel better?**

Let the children talk about a circus or a zoo they have seen or a musical performance they have listened to. Encourage them to discuss whether they felt better after these recreations. Help the children to understand the relationship between recreation and the mental condition of an individual.

Class Project

What is the effect of recreation on the mind?

Help the children to prepare three pictures, one showing a tired and exhausted boy in a playfield, another of the same boy having recreation by listening to music, and still another of the same boy feeling fresh and happily talking to mother. Lead them to conclude about the effect of recreation on the mind.

Let those children who can sing do so individually or in groups. Is it not great fun?

3(c). PLAY ENSURES GOOD SLEEP

The various body parts get exercise during play. After getting sufficient exercise through play, the various parts of the body are ready for rest. The muscles feel tired and the body needs sleep or rest. Through the following activities, the above ideas will be clearer to the students.

Discussion

Does play ensure good sleep?

Invite the children to ask each other during which hours of the day they play, chat or see pictures, and at what time they go to sleep. Does strenuous play exhaust them and make them feel sleepy by the evening? Help the children to know the conclusion that play ensures good sleep.

Let the children recall their experiences of how they fell asleep in the evening when they returned home after a strenuous game.

3(d). PLAY LEADS TO GOOD APPETITE

Playing refreshes the mind. But vigorous play also uses up a large amount of energy. As a result of this spending of energy, the child feels hungry. The following activities will help children to understand that play involves the spending of energy, which then gives rise to hunger and appetite.

Class Project **How does play affect the appetite?**

Allow the pupils to have a sports meet. After play, they feel hungry and need food to eat and water to drink. Exercise awakens hunger which has to be satisfied.

Let the children relate how they bother their mothers for food immediately on their return from the playfield.

4. HUMAN BEINGS HAVE VARIOUS NEEDS

For their well-being and development, human beings need many things. These can be called the essential needs of human beings. Air, water, food, clothes and shelter are such essential things for man to live.

4(a). HUMAN BEINGS NEED TO BREATHE AIR WHICH IS FREE FROM DUST

Man breathes air. This air should be free from dust. Usually there are many particles of dust floating in the air. When sweeping the floor or brushing the furniture, charts, picture frames, etc., dust particles get scattered. The dust particles floating in the air, if inhaled, are harmful to man. To avoid this, the nose should be covered when it is very dusty. An activity like the following will help students realize this.

Investigation **Does air contain dust particles?**

Keep the windows and doors of the classroom open. Ask the children to find out if there is any dust in the air. Let them close all the doors and windows allowing a ray of light to come from one small opening. Particles of dust floating in the beam of light will be seen at once.

Let the children recall their experiences of a sand or dust storm. Let them describe how they coughed and felt choked by breathing air which contained too much sand and dust.

Let some child say what smoke consists of. Why does one cough and feel a choking sensation when one breathes in smoke? Smoke contains tiny particles of carbon. When smoke is inhaled, these *tiny particles cause irritation in the respiratory passage, and produce a choking sensation due to deficiency of oxygen.*

4(b). HUMAN BEINGS NEED TO DRINK WATER WHICH IS FREE FROM CONTAMINATION

Many diseases spread through drinking of contaminated water. To avoid this, one should keep the drinking water free from contamination by isolating it from impurities. The water pot, dipping containers and drinking vessels need to be cleaned daily, and sand may be used for cleaning. The children may be helped to understand this by doing the following activities.

Investigation

Does water contain any impurities?

Materials required
three small pitchers
a vessel
muddy water
gravel
sand

Allow the children to select three small pitchers with a small hole at the bottom of each. Place them one on top of the other (as in Fig. 10-2) on a stand. The top-most pitcher contains muddy water, the middle pitcher contains gravel and the third, fine sand. Below the stand there should be a vessel to collect filtered water from the pitchers. The water will percolate through gravel and sand and will collect in this vessel on the floor. The children can see that the filtered water is clear because impurities have been removed. Help them realize, however, that the bacteria have not been filtered out because they are too small and hence can pass through the pores in the gravel or sand.

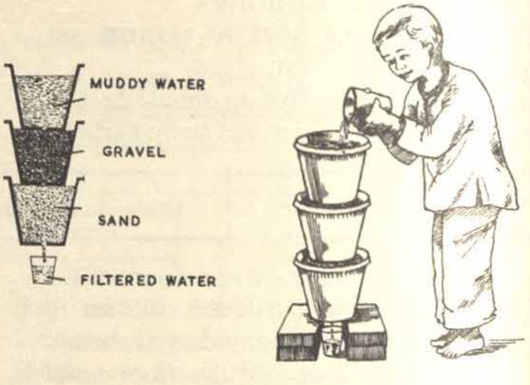


Fig. 10-2
Water can be freed from some impurities by filtering through gravel and sand.

Demonstration

Which type of drinking pot is most hygienic?

Materials required
three drinking pots,
one without a lid,
the other with
tumbler, and the
third provided
with a ladle

Encourage the children to collect three drinking water pots, one without a lid, the second with a tumbler and the third with a ladle. Let the children see the three types and infer that the pot with a ladle is the most hygienic because taking water from the pot with a ladle ensures that water is not contaminated by hand.

Field Trip **How does drinking water get contaminated?**

Invite the children on a visit to a village well or a pond used as a source for drinking water. Help them to observe the sources of contamination of the water from nearby places: (i) drains, (ii) by animals and human beings bathing in it, (iii) by washing clothes, etc., (iv) by decaying leaves. Ignorant villagers may be using this contaminated water for drinking and cooking at great risk to their health. Discuss the importance of preventing contamination of sources of drinking water.

4(c). HUMAN BEINGS NEED TO EAT FOOD WHICH IS FREE FROM CONTAMINATION

Some diseases spread through contamination of food. One should therefore avoid taking such food. Contaminated food contains disease-producing germs. Flies act as carriers of dust and dirt containing the germs. So articles of food should be kept covered so that flies do not sit on them. The food should be taken out of containers with clean spoons or ladles. Before eating the food with the hands, one must take care to wash the hands to remove the dirt from fingers and nails. The following activities may be undertaken to help the children realize this sub-concept.

Investigation **How does food get contaminated?**

Invite the children to peel a banana and keep it on the table. In a few minutes flies will come and sit on it. Next, let the children visit the backyard of cow shed. Hundreds of flies will be seen breeding there. Help the children to understand that flies sit on dung and dirt as also on food, thus spreading contamination and disease.

Field Trip **How does food get contaminated?**

Encourage the children to visit the local sweets shop. See how sweets are kept in glass cases, so as to exclude dust and flies. They may find some shops where the food to be sold is not kept covered. Such food when eaten may cause disease.

Encourage the children to ask mother and find how she ensures that food is not contaminated from dust and flies.

4(d). GOOD FOOD IS ESSENTIAL FOR GOOD HEALTH

There are some definite constituents of food which are needed by the body. These constituents can be obtained from various articles of food. Each article of food gives one or more food constituents, which cannot be replaced by eating or drinking other food articles. One must eat or drink different foods in such a way that there is a balance in the quantities of food constituents thus obtained. Milk, meat, eggs, fish, cereals, pulses, vegetables, fruits, ghee, and oil are examples of nutritious foods. The children can understand the necessity of different foods better by performing the following activities.

Class Project

Preparation of a list of food articles having different constituents

Ask each child to name two articles of food he usually eats or drinks. Let the children study the lists in pairs. Notice that some articles are fatty, others contain more sugar, still others contain more water and salts. Some are of plant origin and others are products of animals.

Class Project

What raw materials go into the preparation of cooked foods?

Let the children name different cooked foods and identify the raw materials which go into their preparation. For instance, rice and water are the raw materials for rice gruel. Mutton, oil, butter, spices, vegetables and onion are the ingredients for meat gravy. For some sweets, milk, lemon, sugar and cardamom are the ingredients. Help them give more examples. Make a list of the materials that go into the preparation of different cooked foods.

Encourage each child to bring one article of food to the class and say how many dishes or types of food can be prepared from it.

4(e). HUMAN BEINGS NEED CLOTHES TO COVER AND PROTECT THE BODY

One puts on clothes in order to cover the body and thus protect it from heat or cold.

One also protects the body against bites of insects like mosquitoes. With activities like the following, one can help the children to understand this sub-concept better.

Discussion

Why are special clothes necessary in winter?

Discuss with the children what kinds of clothes they use in winter. Do they use ordinary cotton clothes or do they wear woollens? Are woollens thicker and warmer than cotton clothes? Help them to appreciate that one needs warmer clothes to keep the body warm in extreme cold.

Discussion

What type of clothes are necessary in summer?

Ask the children if they use blankets or quilts while sleeping in summer. Do they also use skull-caps in summer? Help them conclude that they wear light cotton clothes in summer because of the extreme heat.

Demonstration

Why are clothes necessary?

Allow the children to see the bites of mosquitoes, fleas, etc. on the uncovered parts of the body. Let them see the difference in colour of the covered and uncovered parts of the body bitten by mosquitoes. Such bites can be prevented if the parts of the body are covered with clothes.

Help the children prepare a list of insects like bed-bugs and mosquitoes which sting and against which one should protect one's body.

Show a picture of an Arab traveller in the desert with his camel. Why has the traveller a long, thin, white robe? This is to protect him from the sun and extreme heat. Also show a picture of Eskimoes in thick furry clothing intended to protect them against extreme cold.

4(f). HUMAN BEINGS NEED SHELTER TO PROTECT THEMSELVES FROM THE SUN, RAIN AND OTHER NATURAL FORCES AND ENEMIES

The sun, rain, wind, etc., have many uses. But often one has to protect oneself from these natural forces. Man builds a shelter to protect himself from these natural forces. The shelter also protects him from the enemies. With activities of the following type, the children can be helped to understand these ideas better.

Display Project **What purposes do houses serve ?**

Encourage the children to draw different kinds of houses, cottages, mud houses and brick-built homes and display them in the classroom. Let the children say what purposes the houses serve. How would they feel if they were living in the open?

Help the children recall if they ever got drenched in rain. Did they run for shelter under a tree or inside a house? Narrate the story of the caveman to illustrate how man has progressed in getting better shelter. (Refer to Scientists at Work, Unit 6, class I.)

In the big cities, where buses ply, there are shelters at bus stops where people wait to board a bus. Discuss with the children why these shelters have been constructed and what purpose they serve.

Let the pupils tell the danger they may face in case they do not have any shelter.

5. PHYSICAL GROWTH IS SHOWN BY AN INCREASE IN HEIGHT, WEIGHT AND GIRTH

There is a continuous process of physical growth going on in the case of children. Physical growth is visible from the increase in height, weight and girth.

5(a). CHILDREN GROW IN WEIGHT, IN HEIGHT AND IN GIRTH

Increases in weight, height and girth are some of the apparent signs of physical growth. The growth is not the same in all children and at all intervals of age because it depends on many factors like food, absence of disease and heredity. With the following activities, the children can be helped to appreciate this sub-concept.

Class Project

Do children grow in weight, height and girth?

Let the children measure and note down their weights, heights and girths. Let them note down similar measurements again after an interval of about six months. Discuss with them any changes that are noticed.

Display Project

How much do children grow?

Encourage children to bring their photographs at different ages from the family album. Display them in the classroom. Help the children to see how they have gradually grown big with increasing age.

Let the children draw on paper the outline of the palm of their younger brother or sister, and compare it with the outline of their own palm or with that of their father or mother.

Let the children ask their mothers to show them old clothes which they wore when they were babies. They can now try to put them on. They cannot put them on, because they have outgrown them.

5(b). SOME PARTS OF THE BODY GROW FASTER THAN OTHERS

Children do not grow at the same rate throughout. Also, the rate of growth is not the same for all parts of the body. In a child the legs grow faster and firmer, so that a baby can stand on its legs when it is only about a year old. With activities like the following the children can be helped to understand this better.

Class Project

Do some parts of the body grow faster than others?

Let the children take measurements of the length of their body parts like head, trunk, legs and hands. Let them measure the same after several months or even after a year and note the difference in the lengths of the various parts of the body.

Investigation

Do some parts of the body grow faster than the others?

Materials required
old trousers and vests

Let the children bring trousers and vests they used when they were three years old. Let them try the trousers. They will see that they do not fit them. Let them try the vests. They will find that they can still wear them though with a little effort. It means that the trunk has not grown as fast as the legs in the last two years.

Little girls will see that mother often extends the hems of their frocks as they outgrow them. But no change in the girth of the frocks is necessary. This shows that the legs grow faster.

Scientists at Work

How does the growth of plants differ from ours?

Plants grow and become large trees. The increase in their height and girth is sometimes very remarkable. You may be interested to know in what way plants increase in weight. Let us understand this by studying these illustrations.

Fig. 10-3 shows a young mango tree.

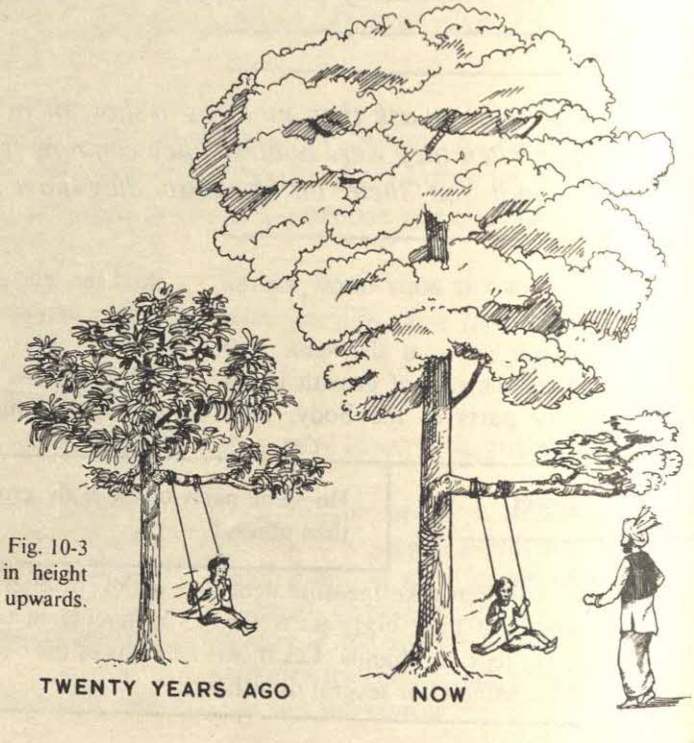


Fig. 10-3
Plants grow in height from the top upwards.

A small boy is swinging on one of its branches. The illustration also shows the tree 20 years later. The boy has now become a father. His daughter is now swinging on the same branch. The branch has grown thicker but still is at about the same height from the ground as it was 20 years ago. This shows that trees grow in height only from the top upwards.

How do children grow? Is it like the growth of a tree? You need not ask your parents and teachers these questions. Like scientists, you can *observe* and get the answer for yourself.

Observe yourself, your classmates, your teachers and parents. *Compare* the lengths of the various parts of their body. You will find that in adults all parts of the body are longer. It means there is growth in height throughout the body.

There is another way to tackle the question of how children grow. Just suppose that a child grows in height like a tree, from the top upwards. Let us try this method and see if it works.

Fig. 10-4 shows a child. Now what would he look like if the growth in height took place according to our method? The second part of the picture shows what an adult would look like if the growth in height occurred only above the shoulders. But no adult is like this. It means our guess was wrong. Is the growth restricted to regions below the waist? Try this guess and you will get the answer. Thus you find that growth in length (or height) is not restricted to any part of the body. Physical growth takes place in all parts of the body.

How nice it is to solve problems by observing, comparing or by making a guess and then trying it out! This is one of the most common ways in which scientists find new information. It is a good way for all of us to learn, too.

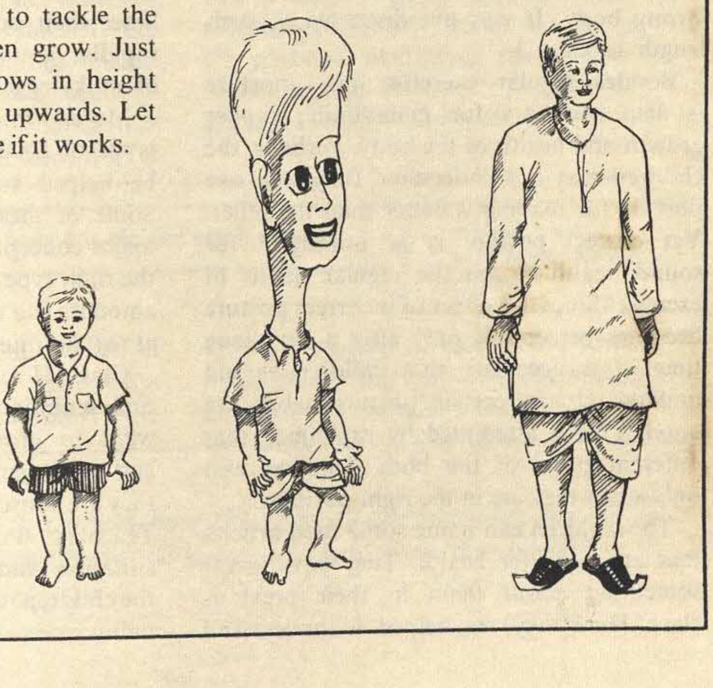


Fig. 10-4
All parts of a child's body grow.

UNIT 10

HUMAN BODY, HEALTH AND HYGIENE

CLASS II

Overview

In class I the children were helped to develop some good habits of cleanliness and regularity in rest, exercise and sleep. Efforts in the same direction are continued at class II level but the treatment is more detailed, in order to develop an understanding as to why the habits are good. The first major concept discusses how exercise leads to the development of a healthy and strong body. It was not discussed at such length in class I.

Besides regular exercise, good posture is also necessary for maintaining proper growth and health of the body. Perhaps, the children may not understand fully why one posture for reading is better than the other. Yet correct posture is as important for sound health as are the regular habits of exercise. Since the effect of incorrect posture becomes perceptible only after a very long time, it is necessary that children should understand *why* certain posture habits are good. This is attempted by explaining that different parts of the body function well only when they are in the right position.

The children can name some food articles that are good for health. They have learnt something about them in their previous class. Here they are helped to understand that foods differ not only in their appearance, taste, smell, etc., but also in that some of them help build bones and muscles, while others provide energy for work and play. Some food articles (fruits and vegetables) help in keeping good health and resisting diseases. This information about classifying food articles on a functional basis will assist the children in getting the idea of a good diet. Since their bones and muscles are growing rapidly, young children should get plenty of milk, eggs, gram, *dal*, meat, etc.

Merely informing children about good types of food is not enough. They should be helped to develop good food habits. Some of these are discussed in the fourth major concept. These habits are about taking the right type of food (clean, fresh) in proper amounts (no overeating or undereating) and at regular intervals.

Class II children are active, energetic, and ambitious. Among other things, they want to grow and become older, larger, and stronger children. This means that they are conscious of their health and growth. Teachers should take advantage of this situation and use this natural interest of the children to help them develop good health habits.

1. EXERCISE LEADS TO THE DEVELOPMENT OF A HEALTHY AND STRONG BODY

In order to have normal growth and development of the body and to maintain health in perfect condition, it is essential that one takes exercise regularly. The human body gets its shape from bones and muscles. Bones form the skeletal framework which is covered with muscles of various sizes, large and small. Bones and muscles work together in a coordinated way. They are responsible for any movement a person desires. Exercise tones up the muscles, improves the blood circulation through the tissues, and thereby helps them to grow stronger. Healthy muscles and bones are essential for general fitness.

1(a). THE BODY HAS LARGE AND SMALL MUSCLES

The bones of the skeleton are clothed with muscles. Muscles are of different sizes; some are big and some are small. Big muscles are normally seen in the limbs, back, neck, etc. Small muscles are found in the eyelids, nose, cheeks, etc. The children will understand this better if they are invited to undertake the following activity.

Investigation | **Does the body have muscles of different sizes?**

Ask the children to lift a heavy article like a large book with the right hand and slowly bend the elbow. The muscle (biceps) in front of the upper arm will be prominent. Let the children feel with their left hand the big muscle extending from the shoulder-joint above to the elbow-joint below, ending in a strong cord-like structure known as a *tendon*. Let them now clench their teeth and feel a stout muscle of the cheek by placing the fingers on the side of the jaw. This is a small muscle extending from the level of the ear to the jawbone. Encourage the children to realize that there are a number of big and small muscles in the body.

Demonstration | **The body has big and small muscles**

Material required
chart of the muscular system

Display in the classroom, a chart on the muscular system of the body. Encourage the children to observe the different muscles of the body, some of which are big and some are small. Let them discuss this.

Invite the children to discuss how the sizes of the muscles vary in different parts of the body. Where can they find the largest one? Where is the smallest?

1(b). BONES AND MUSCLES MOVE THE BODY

1(c). BONES AND MUSCLES WORK TOGETHER

Movement of the body parts like the limbs, head and jaw are all brought about by the joint action of bones and muscles. Muscles are attached to the bones by the tendons. Muscles can contract, and while doing so they become shorter and thicker. When a muscle becomes shorter, it draws nearer together the parts of the body to which it is joined. This produces movement. The children will be able to understand this idea better by undertaking the following activities.

Investigation | **How do bones and muscles move the body?**

Ask the children to stretch out the forearm straight and clasp the muscles of the upper arm with the hand of the other arm. Let them bend the elbow and bring the forearm towards the upper arm. A thickening of the muscles in the front side of the upper arm will be felt as the muscle (biceps) contracts. Help them to realize that a muscle joined to two different bones draws them closer when it contracts. Hence both bones and muscles are responsible for any movement.

Let the children draw a diagram to show the action of the muscle while moving a part of the body.

Encourage the children to move various parts of the body like the jawbone and finger bones. Invite them to discuss how both bones and muscles are involved in action.

1(d). EXERCISE BUILDS MUSCLES

Exercise promotes the circulation of blood through the muscles and tissues, and supplies them with more food for the repair and growth of tissues. The blood also removes the waste from the muscles. One should have some amount of daily exercise in some form like walking, swimming, sports and games or physical training. This helps to keep the muscles in form and in tone. Exercise removes from the muscles the surplus fat which hinders healthy action. Boys and girls who actively exercise their bodies develop better physiques than those who do not. The activities suggested below will help the children to understand this idea better.

Investigation | **Does the use of muscles make them strong?**

Ask the children to carry with the left hand a bucketful of water to a distance. Let them do so with the right hand and feel the difference. The children will be able to perform the job more easily with the right hand than with the left hand. Encourage them to realize that the right hand is more frequently put to use than the left hand in the performance of our daily activities. Thus the muscles of the right hand have become stronger than those of the left hand.

Discussion **Does exercise build muscles?**

Engage the children in a discussion. What is the effect of exercise on the muscles of the body? Where should one take exercise? Does exercise mean physical training? Is it necessary to take exercise daily? Help the children to conclude that exercise helps in building the muscles.

Field Trip **Exercise builds muscles**

Arrange a trip for the children to a nearby gymnasium or *akhara* where they can see people taking exercise. Encourage them to observe how people have developed the different muscles of the body by such regular exercise. Help the children to realize that exercise builds muscles.

Let the children discuss how muscles become weak when a person remains bed-ridden for days together due to a severe and long illness.

Help the children to think about the trunk of an elephant which is very stout and strong. Ask them to state the reason.

1(e). BONES AND MUSCLES GIVE SHAPE TO THE BODY

The bony structure of the body provides the framework which serves for the attachment of different muscles of the body. The bony framework, when properly covered with muscles, gives shape to the body.

Familiar Experience **How do bones and muscles give shape to the body?**

Encourage the children to relate their experience of taking a small whole fish along with their meals. The bony structure remains, after the fleshy portion has been eaten. Both the bony and the fleshy portion contributed towards the shape of the fish. Similarly the skeleton and muscles together make up the shape of a man's body.

Discuss with the children why very fat persons do not have an attractive physical appearance. Such a person has bones, but he has too much fat and not enough muscles developed proportionately.

2. GOOD POSTURE IS NECESSARY FOR MAINTAINING PROPER HEALTH AND APPEARANCE OF THE BODY

The various organs and other parts of the body have a normal position relative to each other. Frequently, children develop poor posture habits which interfere with these normal positions, particularly in the case of posture habits during standing and sitting. Many children stand or sit in a bent and cramped position. This often puts pressure on certain body organs and interferes with their proper functioning. Poor posture in children may have permanent effects on the shape of the bones and joints. Children who continue poor posture habits will develop a body shape which may be impossible to correct later on.

2(a). CORRECT POSTURE IS NECESSARY FOR KEEPING THE BODY PARTS IN THEIR PROPER NATURAL RELATIONSHIP

The natural relationship of parts of the body permits normal functioning of all internal organs. If children develop careless posture habits, they interfere with these normal functions. For example, poor posture can lead to improper breathing, or to faulty digestion. In serious cases, poor posture can lead to headaches or backaches or other discomfort. Children should be encouraged to sit and to stand erect even during relaxation. Here are some activities which can make the ideas of good posture clear to the children.

Discussion

Is correct posture necessary to keep the body parts in their proper natural relationship ?

Ask several children to sit in chairs in front of the classroom. Encourage the rest of the children to observe the different sitting postures and ask them to point out the children who have assumed the correct posture. The correct posture is one where the back of the chair is shaped to fit into the lumbar spine. Let them discuss the harmful effects of bad posture.

Ask the children to recall a case of postural deformity they might have come across.

Display some charts in the class, showing illustrations of correct postures in different situations.

2(b). BODY PARTS FUNCTION BETTER WHEN IN PROPER RELATION WITH EACH OTHER

The different body parts and organs have their proper natural relationship with one another. They can function more smoothly and efficiently if this relationship is not disturbed. When a person gets accustomed to a bent position with rounded shoulders due to bad posture, he not only looks ugly but the movement of his lungs and abdominal organs are also hampered. The children will understand this idea better if they are invited to do the following activities.

Investigation

Do the body parts function better when in proper relation with each other?

Ask the children to sit in chairs with their backs straight and to hold their books at a convenient distance when reading. Now let them sit with body and shoulders bent forward while reading. Let them note the difference. While in the former position, the children will find it easier to read; in the latter, reading is not so convenient and perhaps they feel some difficulties in breathing. Permit them to describe the feeling to the class and ask them to state the reason.

Let the children talk to a school nurse or doctor, if any, about the harmful effects of bad posture.

Let the children tell how they felt when they happened to sleep on high pillows.

3. CHILDREN SHOULD EAT GOOD FOOD FOR HEALTH

The diet of children should be properly planned. Children are usually very active. They need adequate quantities of food for this. Moreover, they are in the process of growth which demands more food. The diet should be prepared by choosing food items from a wide variety of sources in order to promote the healthy growth of the child and to maintain his health at the highest possible level.

Foods are of different kinds. They can be classified on the basis of the functions they perform in the body.

(1) The building foods: these are called *protein* foods. They provide material for building and repairing of the bones, muscles and organs. Without these, the body becomes weak and muscles do not develop properly for work and play. Tissues are continually wearing out during all kinds of activities and they need to be repaired or replaced. This kind of food supplies material for such repair also. Protein foods are usually available from animal foods such as milk, cheese, fish, eggs, meat and vegetable foods such as pulses, nuts and beans.

(2) The energy-giving foods: such foods provide body fuel or energy for work and play. They are of two kinds:
   (a) The *carbohydrates*: these are foods such as rice, *atta*, potato, cane-sugar, honey, glucose. This kind of food gives energy quickly when the body needs it.
   (b) The *fats*: examples are cream, butter, ghee, and oil. The fats do not give energy so quickly as the carbohydrates. They are first stored in the body as fat and provide energy at times of great demand which cannot be met with by the carbohydrates.

(3) The protective foods: they are the *vitamins* and the *minerals* like calcium, iron. Such foods provide the materials which regulate and maintain various vital functions of the body. They are usually found in fruits and vegetables.

Looking at the different types of food, one can easily understand that no single kind of food can supply all the body's needs. The diet of children must contain some food items selected from each category as mentioned above.

3(a). FOODS ARE OF DIFFERENT KINDS

Food provides the raw materials required by the body for various activities. One should select the right kind of foods for health. There are many kinds of food stuffs. They are usually from animal and vegetable sources. The following activities will help the children to understand the idea better.

Field Observation **Foods are of different kinds**

Plan a visit for the children to a nearby market. Encourage them to observe the different kinds of foods kept for sale.

Class Project **What different kinds of foods do we need?**

Ask the children to collect pictures of foods usually taken at: (a) morning meal, (b) noon meal, (c) tea, (d) night meal. Let them arrange the items under two heads: (1) animal source, (2) vegetable source.

Ask the children to name some fruits and vegetables available in the locality.

Arrange for demonstration of a well-balanced meal to the children. The following table gives the constituents of such a meal.

TABLE

A well-balanced diet for a child of seven years

S. No.	Name of the food article	Daily intake (24 hours) in grammes
1.	Cereals	200
2.	Pulses	40
3.	Vegetables (roots and leaves)	150
4.	Milk or milk products	140
5.	Fish, meat or eggs (three times a week)	45
6.	Fats and oils	25
7.	Sugar or *gur*	30
8.	Fruits	One seasonal fruit

N.B. For vegetarians, an equal quantity of extra milk as a substitute for fish, meat and eggs needs to be taken.

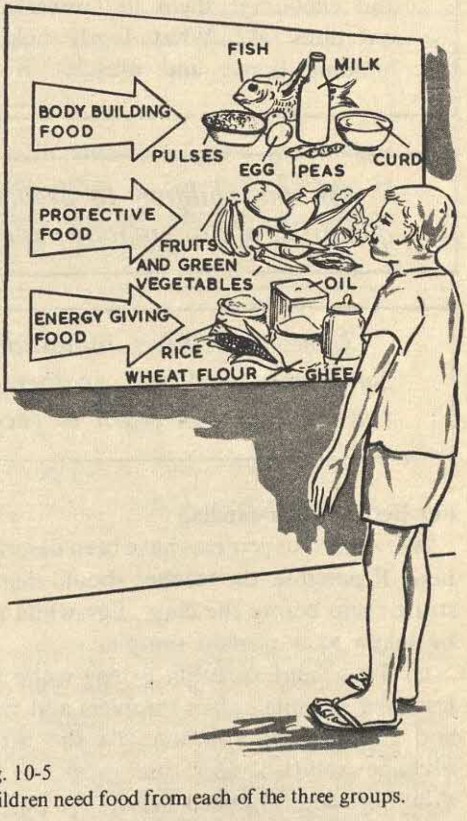


Fig. 10-5
Children need food from each of the three groups.

Display in the classroom a poster showing different kinds of foods needed by the body. See Fig. 10-5.

3(b). SOME FOODS BUILD UP BONES AND MUSCLES

Bones, muscles and organs increase in size with the growth of the body. Also, tissues are continually being worn out at all stages of our life. They need repair. This growth and repair of tissues is performed by a kind of food known as proteins, examples of which are milk, meat, eggs, fish, gram and *dal*. The activities suggested below will help the children to understand this important sub-concept.

Discussion **What foods help build up bones and muscles?**

Engage the children in a discussion and encourage them to answer such questions as: What foods help in building bones and muscles in the body? Do all such foods come from animal sources? Can one manage without such foods? Is there any special name for such foods?

Ask the children to prepare a chart showing the names and quantities of protein food materials taken up by them during a week.

Some proteinous materials burn with a characteristic smell. Small pieces of hair, feathers, and dry meat can be burnt so that the children can learn to recognize the odour.

For Better Understanding

A few tests for proteins have been described here. If possible, the teacher should demonstrate them before the class. Egg-white may be taken as a protein sample.

(i) To a small quantity of egg-white in a test-tube (or small glass tumbler) add water and caustic soda solution. To this strong alkaline solution add one drop of very dilute aqueous copper sulphate. A purplish to pinkish violet colour will be observed.

(ii) To a suspension of egg-white in water, concentrated nitric acid is carefully added. A white precipitate is formed, which turns yellow upon heating. On adding excess of ammonium hydroxide the yellow colour changes to orange.

3(c). SOME FOODS GIVE ENERGY FOR WORK AND PLAY

We require energy for all our activities. Even while lying on the bed we spend some energy on the heart, lungs, kidney, etc. Foods which supply energy are carbohydrates and fats. The carbohydrates are cheap sources of energy. They are quickly broken down in the body to provide energy. Foods like cereals, potato, and sugar belong to this class. Fats provide twice the energy, weight by weight, than the proteins or carbohydrates when broken down in the system. Butter, ghee and oil are some examples of fat. Activities such as the following can help the children to understand the idea.

Investigation

Do carbohydrates give energy?

Materials required
candle
bread

Take a small piece of bread. Ask the children to burn it over a candle flame. Let them notice that some quantity of heat is generated. This is a kind of energy. Help the children to realize that when food is broken down in our bodies, it gives rise to heat and energy in a somewhat similar way.

Familiar Experience

Do fats give energy?

Encourage the children to recall how a lamp is lighted at home with mustard oil. It gives out energy in the form of light and heat. Such a lamp will also burn with ghee, ground-nut oil, or other edible fats. Energy is obtained similarly when fats are broken down in our bodies.

Encourage the children to cut out pictures of good fatty foods and paste them in an album.

Ask the children to bring to the class samples of foods that give energy, and classify them under two heads, viz., carbohydrates and fats.

For Better Understanding

Food articles contain proteins, fats and carbohydrates in different proportions. Some are rich in proteins; others have a larger amount of carbohydrates or fats. When food is digested, proteins, fats and carbohydrates are broken down to soluble substances which are carried by the blood to different parts of the body. This 'soluble food' carried by blood all over the body serves two functions. First, it is used for building up new tissues. Second, it is used as a fuel. The fats and carbohydrates are the main fuels for human body machine.

In a sense one can speak of the carbohydrates and fats being burnt within the body and supplying the energy for various activities, as is the case with coal or oil in engines. Both processes—in the body or in the engine—need oxygen. Yet the burning of fuel within the body is different in that it is extremely slow; and there is no flame produced in it.

3(d). FRUITS AND VEGETABLES ARE REQUIRED FOR HEALTH

Fruits and vegetables provide materials which are essential for some important functions of our bodies. They are necessary for the growth of young children. If fruits and vegetables are not taken regularly, various deficiency diseases may result, and there may be delayed development of bones and teeth. These foods mostly supply vitamins and minerals. Fruits and vegetables should be taken fresh as far as possible and should be consumed daily. Here are some activities which will help the children to become familiar with the idea.

Discussion | **Why do we require fruits and vegetables?**

Is it essential to consume fruits and vegetables? What purposes do they serve in the body? Should one take them daily? After answers are received, help the children to realize that fruits and vegetables are required for health.

Let the children explain the significance of a common statement—'an apple a day keeps the doctor away'!

Let the children be shown a case of bleeding gums. This is due to lack of citrus fruits in the diet.

Take the children to a fruit market to show the different kinds of fruit available.

Some children are habitually constipated. Point out to them that this is probably due to lack of green leafy vegetables in their diet.

For Better Understanding

It has already been seen that proteins are necessary for growth and repair of body tissues. Proteins are particularly necessary for children, and for pregnant and nursing mothers. Deficiency of protein leads to poor physique, stunted growth, lack of vigour and initiative.

Proteins from animal foods like milk, cheese, eggs, fish and meat are rich in chemicals essential for growth. These proteins are superior to those from vegetable sources and are called 'first class proteins'. 'Second class proteins' are chiefly of vegetable origin, like coarse cereals, peas, beans, grams and nuts. They lack some of the protein-chemicals essential for growth.

In our country there are many vegetarians who do not take any animal foods like fish, meat and eggs. They do not get any animal protein which is very necessary as it contains special chemicals essential for growth. They should be careful to have enough milk every day as it is their only source of animal protein and also take an adequate quantity of vegetable foods rich in proteins. One-third of the protein eaten daily should be of the first class.

Scientists at Work

How did man learn to cook food ?

It is interesting to be curious about how we grow. Is it the food, or air, or water, or all of them taken together that make us grow? It seems strange that food makes us grow. Many foods shrink when they are cooked. They are chewed and made still smaller before they are swallowed. And then it makes our bodies grow. How queer it seems!

Yet it is true. Food makes us grow, and some foods are better than others in this respect. You may wonder why parents insist that children get plenty of milk. It is because milk is good for growth.

Many types of foods are available. Some are better for the growth of children than others. But whatever types of food we take, it should be clean. It is never too much to emphasize the cleanliness of food and drinking water for maintaining health. It is dangerous to eat food exposed to flies and dust, or spoilt in some other way.

You may be curious to know about the role of cooking in the preparation of some food articles. All of you will agree that cooking improves the flavour of food. It is much nicer to eat boiled potatoes or rice in comparison to the uncooked material. But, is this all! No, cooking makes the food articles easily digestible. Far more important than these two is the fact that cooking clears the food of harmful germs. The high temperature reached during cooking and boiling kills almost all the germs that may be present in the foodstuff.

Water or milk should also be boiled before drinking. Clean drinking water is very necessary for keeping healthy. Boiling is the most convenient way for making water fit for drinking. It is equally convenient in an urban or a village home to boil water.

Some fruits and vegetables are taken raw. But most of the articles of food are prepared by cooking. Milk is boiled before drinking. You see that heating is closely associated with the preparation of food in the kitchen. And this is true for most people all over the world. You will be interested to know how this practice came to be so persistent and widespread.

After the discovery of fire, ancient man put it to diverse uses, e.g., for heat and for light. Perhaps it was by accident man first got some meat or vegetables cooked in a fire. He liked the flavour and in this way the use of fire for preparing food first began.

Then, probably for many generations, wise men of the old civilization observed that persons using unboiled milk and raw food-stuffs were more likely to fall ill than others taking cooked food and boiled milk. Through such observations of the usefulness of heating food articles, the practices of the modern kitchen became firmly established.

Ancient people did not know how boiling or cooking food materials helps in keeping away diseases. But their observations did help them to discover the right way of processing food materials. These early people made careful observations and they made good use of them. They were among the early scientists of the human race.

4. CHILDREN SHOULD HAVE PROPER FOOD

In order to enjoy sound health, free from any disease, it is essential to observe certain hygienic rules in relation to taking food and water. One should form a regular habit regarding eating. Children should make it a point to eat their meals at regular intervals with at least four hours between any two meals. As chewing increases the flow of saliva, foods should be properly chewed before eating. Foods are not only broken into small pieces but are also provided with opportunity of getting thoroughly mixed with the saliva. Therefore, food should not be taken in a hurry.

While taking food, some children are not careful about the quantity of food they should take. Food should be taken in quantities just sufficient to satisfy the appetite. Extremely heavy meals or light meals should be avoided as they are harmful to health. Hands should be washed before and after every meal, as they get dirty while touching everyday objects and are liable to carry germs to the mouth. One must take special care to wash the hands after going to the latrine. The best way to wash them is to use soap and warm water. The face should also be washed along with the hands.

Food should be fresh as far as possible. Any stale or rotten article of food or drink should be avoided as it may carry germs. Food should be clean and pure and should not only be taken in clean plates but also in clean surroundings. Food exposed to flies and dust may cause disease. Therefore, it needs to be well covered and protected. Water should be pure and safe. It is good practice to boil the water before drinking it so as to kill any germs that may be present in the water.

4(a). CHILDREN SHOULD EAT AT REGULAR INTERVALS

Regular food habits are a basic requirement for maintaining health. Meals should be taken after proper intervals and at fixed hours. This will help in the proper digestion of food. Persons who take their meals irregularly are likely to suffer from digestive troubles like indigestion and constipation. The activities suggested below will help the children to understand the idea better.

Discussion **Why should we eat at regular intervals?**

Ask the children about their usual timings for taking their meals. Ask them why such timings have been kept and if it is desirable to change the time schedules.

Class Project **Do we eat at regular intervals?**

Encourage the children to maintain diaries in which the different timings for taking their meals are recorded. After a month let them say to what extent they have been able to eat at regular intervals. Those who have not been able to do so, may be instructed accordingly. Let the children continue to record the timings. Encourage them to try to improve the regularity of their eating habits.

The children may be encouraged to recall some occasions when they were irregular to some extent in taking their meals. Did they suffer from any abdominal discomfort?

Plan a trip to a nearby boarding school and allow the children to talk to the warden of the hostel regarding the meal times of the students.

4(b). UNDEREATING AND OVEREATING SHOULD BE AVOIDED

While taking meals, it is desirable that one should neither overload the stomach nor eat in insufficient quantities. One should rather be guided by the appetite. Undereating for a prolonged period may lead to under-nutrition. It may result in loss of interest in work, inability to concentrate and poor spirits.

Overeating, on the other hand, may produce excessive fatness or obesity in children. Obesity is an unhealthy condition. It has harmful effects on the organs of the body. The child becomes lethargic, gets easily exhausted and looks sloppy. The children will understand this sub-concept better if they are invited to do the following activities.

Discussion **Why should we avoid overeating?**

Select an obese child. Allow the children to ask him how he feels.

Let them ask him about his usual diet. Help the children to analyze the diet and point out that the child has been habitually eating in excess of his body needs. Lead them to conclude that overeating should be avoided.

They may need to consult a chart indicating the food requirements of a child.

Ask the children to collect pictures of persons who are normal, fat and under-nourished.

4(c). SPOILT FOOD CAUSES DISEASE

Clean and sanitary food is necessary to maintain health. Rotten or stale food may carry germs of disease. Consumption of such articles of food is a threat to health. Foods get easily spoilt in summer. Care should be taken to avoid consumption of spoilt foods. Only fresh foods should be taken. To make the children understand the idea, encourage them to do the following activities.

Investigation | **Does spoilt food cause disease?** | *Material required* milk

Leave some milk open in the air. Ask the children to see its condition and smell it after a day or two. The usual consistency and the flavour are lost due to the presence of some germs in the milk. Lead them to conclude that consumption of such milk is harmful to health and may cause disease.

Familiar Experience | **Is spoilt food harmful?**

Encourage the children to recall an occasion when some particles of food got stuck between their teeth. This may not only result in a foul smell in the mouth but sometimes also swollen and painful gums. This is due to the food particles becoming rotten and germs developing in them. Let the children realize the bad effect that would be produced if spoilt food is consumed.

Ask the children to state why their mothers cut and throw away the rotten portion of vegetables before cooking.

Discuss with the children how a rotten egg or banana smells and the effect that these may produce if consumed.

4(d). FOOD EXPOSED TO FLIES AND DUST IS DANGEROUS TO EAT

Food should be stored in proper places to prevent exposure to flies and dust. Flies and dust carry germs of disease. Therefore, foods for human consumption should not be allowed to remain in the open. Many a disease can be prevented if care is taken not to keep the foods exposed to flies and dust. Here are some activities which can help the children comprehend this important sub-concept.

Discussion

Is food exposed to flies and dust dangerous for health?

Engage the children in a discussion. How does food get contaminated by flies and dust? Why is the consumption of exposed food dangerous for health? How could one avoid food being exposed to flies and dust? After the questions are answered, lead them to conclude that food exposed to flies and dust should not be eaten.

Field Observation

Do we need to protect food from flies and dust?

Arrange a field trip to a sweetmeat shop. Encourage the children to observe that sweets have been kept in a glass almirah and other food articles have been placed under wire-net covers. Encourage the children to give the reasons for this.

Encourage the children to discuss what precautions are usually taken at home to prevent exposure of food to flies and dust.

Discuss with the children, where, besides food, flies are usually found (in stables and around animal droppings, and garbage dumps).

4(e). CLEAN FOOD SHOULD BE EATEN IN CLEAN PLACES AND FROM CLEAN PLATES

It is essential that food for human consumption should be clean and pure. It is unhygienic to take food in unclean plates or in unclean places. Cleanliness in respect of the above should be strictly observed; otherwise disease may result as dust and germs usually go together. The children will be able to understand the idea better by undertaking the following activities.

Discussion

Why should we eat clean food under clean conditions?

Discuss with the children such questions as: Is unclean food harmful to our bodies? What will happen if food is taken in dirty places? Is your plate always properly cleaned before food is served on it? Do your parents insist on cleanliness in relation to food? After they have found the answers, encourage the children to realize the significance of cleanliness in respect of eating food.

Plan a trip to a boarding school to show the children the dining room for the students. Encourage them to observe how cleanliness in relation to food is maintained.

4(f). DRINKING WATER SHOULD BE BOILED

Without water there could be no life. Water is a basic requirement for maintaining health. Water for drinking purposes must be pure and safe. It gets polluted from a wide variety of sources. Germs get into the water in wells, tanks or reservoirs through bathing of animals and human beings, washing of dirty clothes, spitting, and disposing of human and animal waste. Impure water may carry the germs of diarrhoea, dysentery, typhoid and cholera. Water can be purified in many ways like filteration, use of chemicals such as bleaching powder, or potassium permanganate, etc. and boiling. Boiling is a very safe method. All the germs of disease can be killed by boiling the water for five minutes. Hence drinking water should be boiled. This should be adopted as a standard procedure specially when there is an epidemic of water-borne diseases. Here are some activities which can help the children to develop such understandings on the basis of their own thinking.

Discussion

Should we boil drinking water?

Discuss with children the following questions: What dangers may arise by drinking contaminated water? How can we make the water safe for drinking? How does boiling help in removing contamination from water? When is the boiling of drinking water absolutely necessary? Guide the children to realize through such questions the importance of boiling water for drinking purposes.

Arrange for boiling the water to be used for drinking by the children and allow them to observe the procedure.

Encourage the children to discuss how water gets polluted and the effect of polluted water on the human body.

Take the children to a nearby well or tank. Let them observe the sources of pollution of water.

4(g). FOOD MUST BE WELL CHEWED

Some children are in the habit of taking their food in a hurry without properly chewing it. This is a very undesirable practice as they are liable to suffer from stomach trouble. Young children should form a habit of chewing their food thoroughly before eating and should take it in slowly. Chewing has some good effects. It stimulates the flow of salivary juice from the mouth and also breaks up the food matter into small pieces. Both these processes help in the digestion of food. Here are some activities which can help the children become familiar with this concept.

Investigation **How does chewing help in digestion?** *Material required* bread

Ask the children to chew a small piece of bread for some time. Let them notice that the taste gradually becomes sweet. This is because of the conversion of starch into sugar by the saliva.

Investigation **Does chewing help in digestion?** Materials required sugar crystals

Take two glasses both partly filled with water. In one glass, drop a large crystal of sugar (*mishri*) and in the other, a small quantity of finely divided sugar. Encourage the children to observe in which glass the sugar gets quickly dissolved. Obviously the crystal of sugar will take longer. Help the children to realize that chewing the food well has a similar effect.

Ask the children to recall an occasion when they took their food in a hurry without chewing it properly and had delayed appetite and indigestion.

4(h). THE HANDS AND FACE SHOULD BE WELL WASHED BEFORE AND AFTER TAKING FOOD

Hands easily become dirty as they come in contact with many different objects. Dirty material collects beneath the nails. The face is also constantly exposed to dust. Dirt and dust usually contain disease germs which are likely to be carried into the mouth along with the food. Therefore, the hands and face should be properly washed before eating. They need to be washed again, after taking food, in order to have them clean. The children will be able to understand the idea better if they are helped to undertake the following activities.

Investigation

Why do we need to wash the hands and face before eating?

Materials required
vessel
clean water

Ask the children to wash their hands and face with clean water contained in a vessel after the games period is over. Let each child use the same water. Help the children to see that water in the vessel becomes more and more dirty. Help them to understand that the dirty water is likely to contain some disease germs which can be seen only with a microscope. Point out to them the necessity of washing the hands and face before eating. Normally, each person should use fresh, clean water.

Class Project

One should wash the hands and face before and after taking food

Place a towel, soap and water at a convenient place in the school building. Encourage the children to wash their hands and face before and after their school lunch. They need to be observed in this connection.

From time to time the teacher should examine the children after they arrive at school to find out if any food particles are left on their hands or round the mouth. Ask the children to have a wash in the school before entering the class if this is needed.

UNIT 10

HUMAN BODY, HEALTH AND HYGIENE

CLASS III

Overview

In the previous classes the children have developed some good habits for keeping healthy. They keep clean, and they stand sit or walk with good posture. They have developed a liking for wholesome, nourishing food. The children accepted and developed these habits on the basis of understandings about their utility. Since the children were young, the human body was not discussed with them in this connection in the previous classes. A start is made in this direction here at the class III level.

Here in this unit, the basic approach to the study of the human body is functional. Against the background of common experience with the various body functions (e.g., seeing, hearing) the children are helped to develop the concept that the human body works somewhat like a machine. The machine is very complicated in the sense that different parts perform different functions. Moreover there is coordination among the different parts of the body; many organs are often involved in a particular action.

The concept of the human body working as a machine with its different parts in coordination is highly interesting to children. They enjoy discussing how the body works as a machine. They will thus learn to construct models for explaining how parts of the body work.

Different parts of a machine perform different functions. For example, in a cycle, the steering and the braking are controlled by different parts. Yet these movements are coordinated by the cycle rider. Similarly different parts of the body perform different functions. Some parts are for breathing, some for digesting food, others for circulating blood, removing wastes, and so on. In spite of this division of functions, there is extreme coordination. In fact there is one system (the nervous system) for coordination and control of all the other systems.

The breathing system and healthy breathing habits are discussed in the first and second major concepts. When machines work, their component parts move in a quick, regular succession. In fact, a break in this regularity indicates that the machine is not in order. Similarly the heartbeat, the alternate lowering and raising of the chest are symbols of the human body machinery at work. Any irregularity in these movements indicates that something may be wrong. For example, breathing becomes irregular when the body is not functioning normally.

The habits of keeping one's body in good postures and those of healthy breathing go together. Often the wrong posture disturbs the breathing system.

How can children use the idea that the

human body works like a machine? This will help them in developing a correct attitude towards their health. Just as machines work efficiently when properly cared for, so does a healthy body result from good habits of exercise, rest, eating, breathing, etc. Health does not come automatically; people must constantly work for it by developing good habits of health and hygiene, and by understanding the working of the human body.

1. THE NOSE, THE WINDPIPE AND THE LUNGS ARE PARTS OF THE BREATHING SYSTEM

Energy is produced when substances burn in air or oxygen. The body needs energy so that it can carry out its normal functions of life. The food that is taken into the body combines with oxygen but very slowly. The oxygen needed to combine with the food is supplied by the inhaled air.

There are various ways of taking in air into the body of an animal. A fish takes in air through its gills; an insect breathes through tiny holes in its body. A man has one of the finest and most complex systems for breathing. The air is first taken in through the nose. The passages of the nose are connected to a tube called the windpipe. The air passes through the nose into the windpipe and then into the lungs. The lungs are two elastic, bag-like organs.

When breathing in, the lungs enlarge as the air fills in. The ribs push out and the chest expands. In breathing out, the lungs become a little flattened and the air is forced out.

The air breathed in is normally fresh air, while the air breathed out contains carbon dioxide and water vapour and other wastes. Whenever a person sits idle or does some writing or sewing he breathes slowly, 10-12 times a minute. But when he runs or jumps or does other violent exercise, he breathes much faster.

1(a). THE CHEST EXPANDS WHEN BREATHING IN AND CONTRACTS WHEN BREATHING OUT

Every time a person inhales, his chest becomes big or *expands*. Every time he breathes out, the chest flattens a little or *contracts*. This happens because the chest gets bigger in the first case and the air is forced in through the nose or mouth. When the air is breathed out, the lungs contract, and this forces air out again.

The children can be helped to follow this idea by undertaking activities of the following type.

Investigation

How does the girth round the chest vary with breathing?

Material required
string

Allow the children to remove their shirts and group themselves in pairs. Let each pair have a piece of string, long enough to bind around the chest with a little excess length. Let one child measure the girth round the chest of his partner, when the chest is normal. Let the child put a mark on the string where both the ends meet. Let his partner breathe in. Let the child say if the distance round the chest of his partner has increased or decreased.

Then let the partner breathe out. Has the distance round the chest now increased or decreased? When the experiment is over, let the child who was being measured take the measurement of the child who had measured him. See Fig. 10-6.

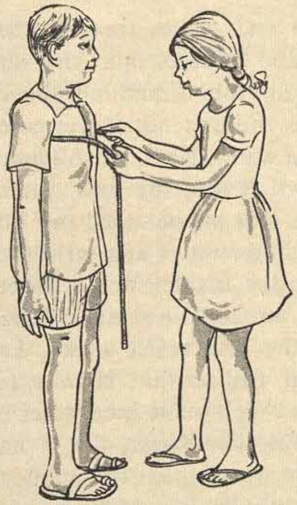


Fig. 10-6
The girth round the chest varies during breathing.

Wind and tie a piece of cotton thread around the chest of a child who has breathed out all the air he can; when he inhales, the thread snaps because the chest has expanded.

1(b). INHALED BREATH IS FRESH AIR ; EXHALED BREATH CONTAINS WASTE

The air breathed in contains oxygen which is necessary for the burning of the food that is eaten. In burning, substances give out waste-products, such as carbon dioxide. The air normally contains about four parts in 10,000 of carbon dioxide. In breathed-out air, there may be up to four per cent carbon dioxide. In other words, the air breathed out contains 100 times more carbon dioxide than what is contained in the air breathed in. In addition to this, exhaled air contains water vapour. The children may be helped to understand these facts by carrying out the following activities.

Investigation **What does exhaled air contain?**

Materials required
bottle with a wide mouth
cork
two bent tubes
lime water

Let the children bore two holes in a cork that fits any bottle with a wide mouth. Fix two bent tubes A and B into the holes made in the cork as in Fig. 10-7. Put some clear lime water in the bottle and adjust tube B so that one of its ends dips into the lime water. Bubbles are formed in the lime water as one takes in air through tube A. The air one takes, enters through the

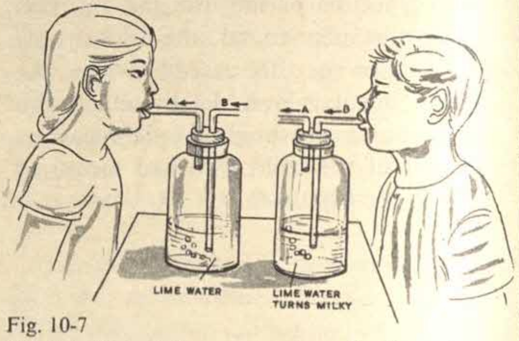


Fig. 10-7
Exhaled air contains more carbon dioxide and therefore quickly turns lime water milky.

tube B and passes through the lime water and bubbles out. This air then enters into tube A and into the mouth. Let the children notice the colour of the lime water. Next, let children blow out from B into the lime water, and observe that air breathed out bubbles through lime water and turns the lime water milky. In other words, the breathed-out air contained something that made the lime water milky. Let the children realize that it was carbon dioxide which made lime water milky. To make lime water, put a handful of lime (quenched or unquenched) into a litre or two of water and stir well. Allow this to stand overnight. Pour off the clear lime water and discard the sediment which remains.

Have the children exhale on a cold surface of a mirror. Let them observe what happens. The reflecting surface becomes misty. This mistiness is caused by the water vapour present in the air which one breathes out.

1(c). BREATHING IS FASTER DURING VIOLENT EXERCISE

It is observed that a person breathes faster when he runs or climbs. The same thing happens when a person lifts heavy loads or does other exacting work. The children will understand this better by carrying out the following activities.

Investigation

Is there any relationship between breathing and work?

Material required
watch

Let the children count their breathing (both inspiration and expiration) for a minute and record their numbers. Invite some of them to run around a circle of about 50 metres' circumference. Ask some other children to climb up the stairs quickly. Ask some boys or girls to lift a heavy stone kept on the ground. Let all the children count their breathing per minute after all such activities and record it on a piece of paper. They will notice an increase in the rate of breathing in all the cases. Help the children realize that the increased breathing is due to work or other violent exercise.

Encourage the children to carry buckets of water to irrigate the garden. Let them see how heavily they breathe while doing this work.

For Better Understanding

The air is inhaled in the body through the nose and travels to the lungs through the windpipe. The lungs are made up of many tiny air sacs. Each air sac has a very tiny tube entering it. These tiny tubes join and rejoin to form one big tube. The windpipe is connected to each lung by means of the big tube present in each lung. At no time are the lungs completely empty. There is always some air left. This air is known as *residual air*. Even if one tries to breathe out forcibly, the lungs will contain some air.

Since heat energy is formed by burning of food materials in the body, it is but natural that when more energy is needed, more food has to be consumed in the muscles to get more heat energy. To burn more food, more oxygen is needed. To get more oxygen into the body, one has to increase or quicken the rate of intake of air. This is why a person breathes faster when running or working.

2. HEALTHY BREATHING HABITS ARE ESSENTIAL

The air one breathes in is not always very pure. This air must be cleared of dust and germs and also be warmed. The nose serves this purpose well. The structure of the nasal passages provides a three-way air-conditioning system. It acts as a filtering agent. This filtering is done by means of fine hairs in the nasal passages. Furthermore, the nose is divided into bony compartments or shelves, which are lined with tissues containing glands which secrete mucus. This mucus traps particles which may pass through the hair filter. Finally, there are in the nasal membranes cells which have fine whip-like projections on their surface. The continuous lashing of these projections keep in motion the fluid secretion covering these cells.

Besides removing dust and germs, the air passages of the nose warm and moisten the air breathed in. For health it is important that one cultivates the habit of good breathing. Proper breathing is done through the nose, and not the mouth. One should discard tight-fitting clothes around the chest and abdomen. These restrict the movements of the chest and do not allow one to breathe freely.

Since air that is breathed out contains plenty of carbon dioxide and germs, it is unhygienic to breathe the same air over and over. One may fall sick by breathing impure air. Equally important is good posture for breathing. One should sit or stand erect while breathing and thus fully inhale good fresh air.

2(a). THE NOSE CLEANS AND WARMS THE INHALED AIR

The nasal passages are warm with body heat. Therefore, the air passing through these passages gets warmed up. By the time the air reaches the air sacs of the lungs, it has become warm. Thus the inner lining of the lungs is protected from damage by cold or excessively hot air breathed in.

The air entering the lungs through the

nasal passages is cleaned of dust and other solid impurities in the air. This is done by the hairs growing in the nose passages and by the mucus which is present in the nose, as well as by whip-like projections called *cilia*.

It is thus clear as to why it is necessary to breathe through the nose. When tonsils and adenoids are swollen, the air passages to the windpipe are blocked. One is forced to breathe through the mouth with the result that one can get sore throat. Besides this, breathing through the mouth spoils the facial expression. The children can be helped to understand how the air is warmed up by its passage through the nose, through the following activities.

Investigation

How does air get warmed while passing through the nasal passage?

Materials required
copper or aluminium or glass tubing
spirit lamp or candle

Help the children to get a length of copper or aluminium or glass tubing. Heat the middle part of the tubing, as in Fig. 10-8. When the middle part becomes hot, blow at one end into the tube. Have a child place his hand at the other end of the tube. How does the air feel? The air striking the palm of the hand will be found warm.

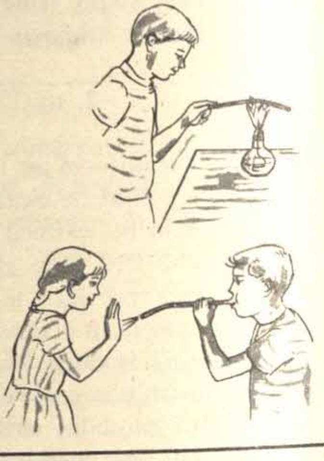


Fig. 10-8
Air is warmed during its passage through a hot region.

Investigation

Is air filtered while passing through the nasal passage?

Materials required
coal dust
handkerchief

Let the children appreciate that when air is made to pass through damp cloth, it will be filtered as if it had passed through water. To illustrate this, let children blow over coal dust and breathe the air thereafter. After that, let children come to a quieter place and use a clean handkerchief to wipe the interior of the nose. The children will see that the clean handkerchief becomes blackish and dirty at the spot where it was used. It shows that the dust particles breathed in with air were caught by the filtering action of the nose.

Let the children create some dust by blowing over coal and inhale it through a moist handkerchief kept in front of the nostril. They will see the coal dust sucked in and stuck to the handkerchief.

2(b). TIGHT-FITTING CLOTHES AROUND THE WAIST AND CHEST SHOULD BE AVOIDED

Any tight-fitting garment is not only uncomfortable but also a hindrance to the free movement of the parts of the body it covers. Clothes which fit tightly around the chest and waist restrict the expansion of the chest and thereby make breathing difficult and uncomfortable. The children can be helped to appreciate it by performing the following activities.

Investigation

Do tight-fitting clothes interfere with free movement of the chest?

Materials required
shawl or a piece of cloth

Let the children tie a shawl or a piece of cloth tightly around the chest and the waist. Let them do some exercise such as sitting and jumping alternately. Let them find out the defference by doing the same exercise without any shawl tied around the chest or waist.

Encourage the children to arrange a sack-race or a three-legged race. Discuss with them why the participants are not able to move freely. This is because their limbs are hindered from free movement.

2(c). THE SAME AIR SHOULD NOT BE BREATHED OVER AND OVER AGAIN

The air breathed out (exhaled) contains as much as 100 times more carbon dioxide than the air inhaled. The exhaled air carries with it more carbon dioxide and less oxygen. It is harmful, therefore, to breathe the same air over and over again. The children may be helped to understand this by undertaking the following activities.

Investigation

Is it desirable to breathe the same air over and over again?

Materials required
water container
glass cover
mouse trap
mouse

Bring to the class a mouse in a trap (cage type). Place it in a container partly filled with water which the children observe. Cover the mouse and the trap with a glass jar as shown in Fig. 10-9. The air inside the cover will gradually become more and more stale and a part of the air (oxygen) will be used up. The mouse will become more and more sluggish as the air becomes more stale. Let the animal have fresh air before he begins to suffer. Help the children to realize that the same air breathed over and over again gets depleted of oxygen. As such, it is impure and should not be breathed.

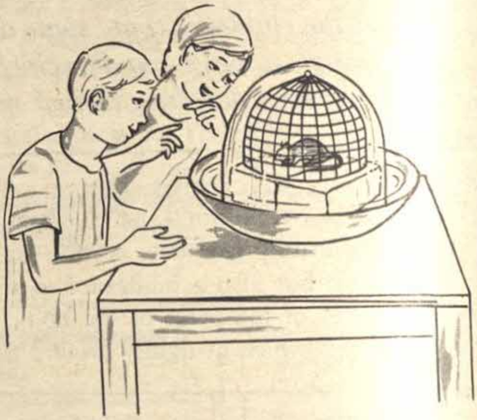


Fig. 10-9
It is not desirable to breathe the same air over and over again.

Investigation

Should we breathe in the same air over and over again?

Materials required
towel or bed sheet
or paper bag

Let the children cover their heads with a towel or a bed sheet or a paper bag. Ask the children if they feel suffocated, and if so, when. Help them to understand that impure air makes them giddy.

Caution. Do not tie the towel or bed sheet as some one may be gagged and become unconscious.

3. THE HUMAN BODY IS SOMEWHAT LIKE A MACHINE

Like any machine the human body needs fuel. That fuel is supplied by the food which supplies energy through burning. Just as a machine has many parts which together do a major job, so also does the human body have many parts which do any work like that of growing or moving, by coordination.

The different parts of the body do different types of work. For instance, the *ear* is the organ of hearing. By means of this organ a person is able to recognize sounds. The *eye* is the organ of sight. By means of eyes a person is able to see the objects around him. Similarly the *nose* serves the purpose of smelling. Different odours are picked up by the nose and their sensations relayed to the brain where the smell is then recognized. A person tastes by means of the organ called the *tongue*. The *skin* serves as the organ of feeling. All these organs together keep the body informed of the surroundings.

There are other organs in the body which do a different type of work such as moving about, breathing, digesting food, circulating the blood and removing the wastes from the body. The body can remain healthy only if all the organs of the body work properly. Deficiency of function in any one of the organs may cause discomfort or illness.

3(a). THE SENSE ORGANS MAKE IT POSSIBLE TO SEE, HEAR, SMELL, TASTE AND FEEL

Every living creature has sense organs which enable it to recognize and orient itself to the surroundings in which it lives. Human beings have five senses. The eye is the organ of sight. By means of eyes one recognizes objects in one's surroundings and measures them for size and shape. By using his eyes, a man is able to see danger and protect himself from it. Sight helps one to find one's food and to admire the beautiful things in nature. Thus eyes are important sense organs for a person.

Ears, too, are important. The ears help man to recognize various kinds of sounds. By means of his gift of hearing, one can protect himself from approaching dangers. The nose is a sense organ which identifies odours. By smelling one can know what things are good and pleasing to the body and what things are bad. By smelling, a man can avoid eating decayed food or living in filthy places. Taste is sensed by the tongue. The tongue is able to recognize sweet, bitter, sour tastes, and many others. The sense of touch is provided by the organs of sense in the skin. A person can protect himself against sharp instruments or hot objects which may cause him harm, by feeling them with the surface of the skin.

In order to help the children understand the value of the various organs of sense, let them carry out the following activities.

Investigation **What are the functions of the different sense organs?**

Let the children close their eyes and try to walk. They will grope and stumble. Let the children cover their ears completely and try to hear and find out from which direction a sound is coming. Let them close their nose and find for themselves if they can sense any strong smell such as that of vinegar. Leave the nose open and ask them if they can now smell the vinegar. Let the boys and girls take a pinch of salt and put it on their skin. Ask them how they feel. Then let them put it on the tongue and state what taste it has.

Allow the children to light a candle and hold a nail for a second or two over the flame. Let them touch the nail and feel that it is hot.

3(b). DIFFERENT ORGANS IN THE BODY PERFORM DIFFERENT FUNCTIONS, SUCH AS BREATHING, DIGESTING FOOD, CIRCULATING BLOOD AND REMOVING WASTES

Besides sense organs in the body, there are other organs which serve the purpose of maintaining the body in good condition for work. The oxygen of the air is utilized through the functioning of the lungs. The food that is eaten is digested by various juices in the digestive tract. The heart circulates the blood to various parts of the body and all the waste matter formed in the process of burning and breaking up of food and tissues is thrown out by the kidneys, skin, and the lungs. The children will understand these ideas better if they are encouraged to do the following activities.

Demonstration

How do different organs of the body perform different functions?

Materials required
frog
chloroform
wooden board
pin scalpel
tweezer

Bring a live frog and make it unconscious by using chloroform. Pin the frog to a wooden board with its stomach upwards and cut the stomach gently, taking care not to incise it too deeply. By using tweezers pull apart the sides severed, as in Fig. 10-10. This will bring to view the internal organs of the frog. Encourage the children to observe how the heart pumps and how the vessels carry away the blood. Let them see the lungs, the digestive organs and the kidneys as well. Show them charts or models illustrating different organs of a human being.

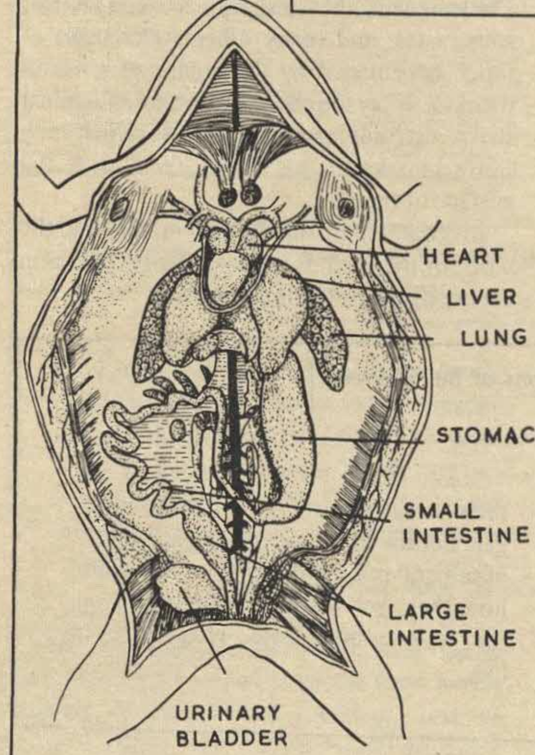


Fig. 10-10
The different organs of a frog.

Field Trip

Different organs in the body perform different functions

Take the children to a nearby meat shop. Encourage them to observe the different organs of a goat, like the heart, the lungs, the stomach, the intestines, and the kidneys. Let the organs be dissected so that the children can see the structures inside. Encourage them to recall what they have previously learnt about these organs.

Encourage the children to draw and label the different organs like the kidneys and lungs of a man.

4. MANY ORGANS ARE INVOLVED IN A PARTICULAR FUNCTION

Just as a machine has different systems, so also has the human body. A car has a system for cooling the engine; it has a system for ignition, that is, supplying a spark through the sparking plugs at the right time; then there is the lubricating system and the power system. Similarly a body has many other organs doing their share of work and helping the whole person to function properly.

The digestive system is responsible for digesting the food one eats and converting it into substances which can be easily absorbed by the cells. Many parts of the system have to do their work before the food is finally ready for absorption and use.

The heart and the blood vessels do the work of supplying the blood to all parts of the body. The heart pumps blood through long rubber-like tubes to the different parts of the body. The thread-like tubes are the blood vessels. The vessels that carry blood from the heart are called *arteries*. The vessels which bring blood back to the heart, are called *veins*.

Salts and water are removed from the body through the surface of the skin. The large intestine collects waste matter and undigested food as a solid refuse, and expels it from time to time.

These are examples of the major systems of the body. Working together, these systems help the person to move and grow and work and live.

4(a). FOOD PASSES THROUGH THE MOUTH, GULLET, STOMACH, SMALL INTESTINE AND LARGE INTESTINE ; THE UNDIGESTED PART PASSES OUT

The digestive system is made up of many organs. Thus there is the mouth where the food is cut into pieces; the gullet which carries the food from the mouth to the stomach where it remains for about four to five hours to be made into a paste by the juices of the stomach. From the stomach the food passes to the small intestine where it is further digested as it passes slowly through its entire length of about 7 metres. The small intestine is connected to the large intestine. The large intestine keeps the food long enough to absorb the water contained in the waste. When all the water that is needed for the body is removed, the waste is thrown out of the body as faeces.

Every organ of the digestive system does its job in helping food to get digested. The children can be helped to appreciate this by performing the following activities.

Investigation

How do the different organs of the digestive system help in the digestion of food?

Let the children bite a piece of bread, grind it with their teeth and chew it till it becomes like a paste. Ask them if the taste of the paste has changed. It should taste slightly sweet. Point out that the mouth has saliva which when thoroughly mixed with the pieces of bread will convert some of the bread (starch) into sugar. Help the children to realize that the stomach and intestines too have juices which help to digest the rest of the food.

Discussion

What are the different parts of the digestive system?

Encourage the children to make a labelled chart of the digestive system showing the different organs in the system. See Fig. 10-11. Lead them to a discussion about the functions of the various parts of the digestive system.

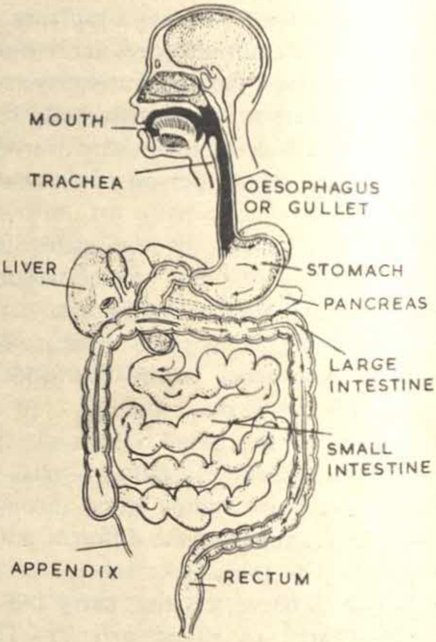


Fig. 10-11
The different parts of the human digestive system.

Let the children also see the digestive system of a dissected frog. Help them to draw a labelled figure of the digestive system.

4(b). THE BLOOD IS PUMPED BY THE HEART AND DISTRIBUTED TO ALL PARTS OF THE BODY BY MEANS OF BLOOD VESSELS

The heart is an organ, a little bigger than a closed fist. It lies between the two lungs. The heart is divided into two compartments by a wall so that there is no direct connection between the two sides. The heart, though small, is a powerful organ. It acts as a pump. One compartment pumps blood to the lungs and the other compartment pumps blood to different parts of the body. Each compartment is further divided into two parts separated by a valve.

Connected to the heart are the blood vessels. They carry the blood to and away from the heart. The blood vessels are hollow tube-like structures. There is a network of these throughout the body. The smallest ones are called the capillaries. The arteries carry the blood away from the heart and the veins bring the blood back to the heart. The children can understand the circulation of blood better by doing the following activities.

Investigation

Does the heart circulate the blood to various parts of the body?

Material required
watch

Let the children be divided in groups of two. Let each of them feel the other's heartbeat with the palm of his hand. Also ask them to feel simultaneously with the fingers of the other hand either the radial artery near the wrist or the temporal artery in front of the ear.

Help them to understand that the heartbeat and the pulsations of the arteries coincide. Encourage them to find out how many times the heart beats in a minute. Help them to understand that the heart circulates the blood to various parts of the body.

Display Project

The heart distributes the blood to different parts of the body

The children may be helped to draw a diagram of the heart showing its chambers and indicating the direction of the blood flow by means of arrows. If possible, a film or a filmstrip on 'The circulation of blood in the human body' may by shown and a discussion may be conducted after the show to make the subject quite clear to the children.

Have the children draw a large labelled diagram of the circulatory system of man, with arteries shown in red and veins shown in blue.

Let the children obtain, if possible, the heart of a goat from the butcher. Let the children examine it by cutting the heart across its centre.

4(c). THE HEART PUMPS THE BLOOD INTO THE LUNGS WHERE IT LOSES CARBON DIOXIDE AND GETS OXYGEN

The impure blood containing carbon dioxide is brought to the right side of the heart. From here it is pumped to the lungs. Here, exchange of carbon dioxide with oxygen takes place. The blood with oxygen in it returns to the left compartment of the heart. This compartment has strong muscles, which pump the blood to various parts of the body. The children will understand this better when the following activities are undertaken.

Display Project

What is the direction of the flow of blood through the lungs?

Materials required
black board
chalks

Let the children draw a diagram of the heart and show the blood vessels which connect the lungs to the heart. Let them use blue chalk for the vessels which carry blood to the lungs from the heart and red chalk to show the vessels which carry oxygenated blood to the heart. Let the children show the direction of the flow of blood from the left side of the heart to the right side of the heart, through the lungs, by means of arrows drawn in white chalk. See Fig. 10-12a, b.

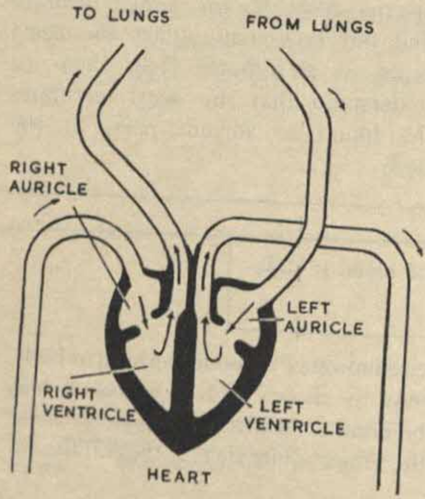


Fig. 10-12a
Blood flows from the right side to the left side of the heart through the lungs.

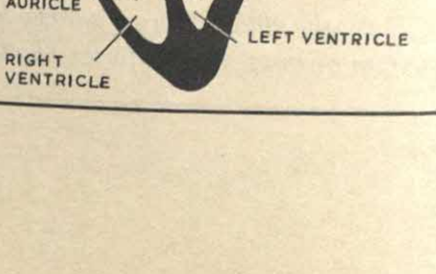


Fig. 10-12b
The flow of blood through the heart.

If a model is available, discuss with its help the flow of blood through the heart and lungs.

Scientists at Work

William Harvey investigates the circulation of the blood

Less than 350 years ago, people, including medical men, did not know that blood circulates through the body. It seems very strange now that, knowing as they did about the life-long movement of the heart, they did not ask what work the heart does. What is its function? The credit of putting this question, and demonstrating a true answer, goes to William Harvey. You will be interested to know more about this man and his work.

William Harvey was born at Folkestone (England) in 1578. At the age of 19 he got his Bachelor of Arts degree. Having chosen medicine as his profession, he went to Italy to study at the University of Padua. Harvey got his medical degree in 1602. He returned to England and settled in London.

At the age of 31, Harvey was appointed physician at a famous hospital in London. At 37, he started working as a lecturer in that institution. It was during the course of such lectures that he demonstrated the general circulation of blood from the left side of the heart, through the aorta and its subdivisions to different parts of the body. He also showed that the veins collect and bring this blood back to the right side.

He published in 1628 (at the age of 51) the results of these investigations in the form of an essay entitled 'Essay on the Motion of the Heart and the Blood in Animals'.

He spent many years of his life finding out how blood circulates. It was a long and difficult task. But then why did he do it? He himself said that he was very curious about the motion and uses of the heart. Furthermore, he said that he was not satisfied simply to read what others had written on the subject. It would satisfy him more, he thought, if he could make direct observations of his own, and gather first-hand evidence.

So this was what urged William Harvey to his great task—his own curiosity, and his desire to have it satisfied! And to satisfy it he did experiments, recorded his observations and reported them to others in the book he wrote.

In many ways you are behaving in the same manner, are you not? You are learning that it is good to be curious, and that it is good to try to satisfy that curiosity. Also, you are learning that one way to get information is through first-hand observations. In many ways, you are enjoying the process of science just as William Harvey did. In many ways, you too are a 'Scientist at Work'!

4(d). THE LUNGS, THE KIDNEYS, THE SKIN AND THE LARGE INTESTINE REMOVE WASTES FROM THE BODY

The food that is taken in provides energy which is used by the body. But in this process, waste products are formed. When the food absorbed by the body is burnt, carbon dioxide is given off. These waste products, if allowed to remain in the body, cause harm. It is, therefore, essential that the waste products are eliminated as soon as they are formed. The body has systems which take care of this removal.

The lungs get rid of carbon dioxide. The skin removes water, salts and other wastes. The large intesting removes the undigested food through the anus. Help the children to understand this by performing the following activities.

Discussion

How are the waste products removed from the body?

Encourage the children to understand that urine is a waste product. It is acidic. The acidity of urine may be tested by using blue litmus paper. The litmus paper will turn red when dipped in urine. The children know that most acids are harmful. Urine is also acidic. Let boys and girls understand that urine, faeces, sweat and carbon dioxide are waste products excreted from the body. They are the end-products of the physiological activities of a living body. Encourage them to realize that different waste products formed in the body are excreted by different organs.

Call the students' attention to the odour of perspiration. This indicates that in normal perspiration, the body eliminates waste material through the skin.

UNIT 10

HUMAN BODY, HEALTH AND HYGIENE

CLASS IV

Overview

Food, teeth and microbes are the three main areas discussed in this unit. These areas are not as isolated from one another as they might appear. Of the three functions of good teeth described in this unit, a very important one is to chew food. Similarly a knowledge about microbes is important in understanding the role they play in food processing or food preservation.

There are six major concepts under 'Food'. The first of these deals with how the body utilizes the eaten food for energy and for growth. Here the children are helped to understand why digestion is necessary before the food is used by the body. There is a description of some types of food that are taken raw (i.e., uncooked). Next, there are three major concepts related to cooking. The discussion is aimed at such ideas as why some foods are cooked, and the different ways of cooking. These are useful understandings about health and hygiene, based on children's everyday experiences with the kitchen.

The last major concept under 'Food' deals with the need of protection (against microbes etc.) and preservation of food. Several methods for safe storage of food are discussed here.

There are five major concepts about teeth and their care. After describing the usefulness of good teeth the unit deals with different types of teeth, with tooth decay and with proper care of the teeth. These understandings developed in this unit will help children see the necessity of regularly cleaning their teeth. They will, therefore, easily accept these habits.

In the previous classes, children have repeatedly seen the importance of keeping clean for maintaining good health. A proper attitude towards cleanliness cannot be developed without a basis of some information about microbes. In class IV, children are somewhat older and can therefore be given some information about microbes. The material here provides some general information about microbes—their occurrence, size, variety and conditions for their growth. Attention is also given to how some microbes are useful to man and some are harmful. Lastly, the children are helped to learn how the body protects itself from disease germs. This helps to tie together all the information about microbes discussed in this unit.

1. THE BODY CHANGES THE FOOD EATEN, INTO A SOLUBLE FORM WHICH IS ABSORBED AND USED FOR ENERGY AND GROWTH

The food man eats is digested by the digestive system of the body. The system consists of the alimentary canal, about 9 metres in length, and the glands whose secretions are poured into the digestive tract. The digestive process starts in the mouth. Here food is chewed, softened and mixed with saliva. In the stomach and the small intestine, food is further acted on by other digestive juices. These include the gastric juice, the bile, the pancreatic juice and the intestinal juice. As a result of this continuous process of digestion, the food is broken up into simple and soluble compounds. These simple compounds are suitable for absorption into the human body from the digestive tract. The solid constituents of food are thus converted into a liquid form. The starchy foods are changed into simple sugar; fats are broken down into mixtures of simple absorbable materials and proteins are reduced to amino acids. In these forms, the various nutrients of the food are absorbed by the body to be used later on for energy and growth.

1(a). FOOD IS BROKEN INTO SMALL PIECES BY THE TEETH

Food is digested in the alimentary canal, or 'food tube'. The process of digestion starts with the action of the teeth. In the mouth the food is cut up by the front teeth and ground up by the back teeth. At the same time, the food is moistened and softened by the saliva. By the repeated action of the teeth, the food is mixed into a paste. After the chewing is completed, the food is swallowed. The following activities will help the children to understand the idea better.

Investigation

How is food broken into pieces?

Materials required
guavas
knife

Let the teacher bring a bag of guavas to school. Ask two of the girls to wash the guavas. Let one of the boys, after washing his hands, cut the guavas into quarters and pass the fruit to all class members. When everyone is served, ask each one to think about chewing as they slowly eat the pieces of guava. Ask them to state later on the work that the different teeth did.

Discuss with the children the function of teeth in relation to food.

Ask the children to state the reason for their grandfathers using artificial dentures.

Ask the children to make drawings of the different kinds of teeth that they possess.

1(b). DIGESTIVE JUICES MOISTEN AND DISSOLVE PART OF THE FOOD

Food in the alimentary canal is acted on by a number of digestive juices, starting with saliva in the mouth. As the food proceeds downwards, it comes in contact with the gastric juice in the stomach, and the bile, the pancreatic and the intestinal juices in the small intestine. Food is moistened by these different digestive juices. The various portions of food-stuff, like proteins, carbohydrates and fats, are broken down into simpler and more soluble products by digestion. The food is ultimately converted into a liquid, with different kinds of foodstuffs dissolved in it. Fats are not dissolved; they remain in a finely divided form called emulsion. This helps the foodstuffs to be easily absorbed in the blood through the wall of the intestine. The activities suggested below will help the children to become familiar with this idea.

Investigation

How does saliva function?

Material required
sugar

Ask the children to keep a small quantity of sugar in the mouth. Let them chew it for some time. The sugar gradually moistens and becomes dissolved by the saliva.

Discuss with the children how digestive juices change food into a soluble form and thereby make the food usable.

Ask the children to draw a diagram of the different organs and indicate the places where different digestive juices help in the digestion of food.

2. SOME FOODS ARE EATEN RAW (UNCOOKED)

Various types of food are used to get nutrition. Some of them are cooked before eating. Foods like fruits, nuts and some green vegetables are even eaten raw. Fruits like *amla*, lemons or oranges, and the green vegetables are rich in a particular vitamin which helps in preventing scurvy. This vitamin is lost by cooking. Some portion of water-soluble vitamins and some minerals may also be lost by cooking the leafy vegetables. Nuts being rich in protein and fat have high nutritive value. They are not easily digestible and cooking makes them even less digestible.

Fruits and vegetables should be thoroughly washed before eating as they are liable to be contaminated with germs of different diseases from a variety of sources. Cut fruits when kept exposed to dust and flies in a market are often very dangerous because of the germs contained in them.

2(a). FRUITS AND VEGETABLES SHOULD BE WASHED AND STERILIZED BEFORE EATING

Vegetables are grown on soil. The soil often gets polluted. The bowel movements of men and animals make the soil very unhygienic. Sometimes, the soil is treated with sewage water. Vegetables grown on such lands are liable to give rise to diseases like diarrhoea, dysentery and typhoid fever. The vegetables may also convey parasitic infection.

Fruits and vegetables may be contaminated with disease germs in a number of ways. They are usually exposed to dust and flies which are liable to carry germs. They are often handled by dirty hands during the transit from the source to the consumer. All these point to the necessity of sterilizing (freeing from germs) fruits and vegetables by washing or in some other way before eating.

Fruits can be made free of germs by the use of a dilute solution of potassium permanganate. This is more necessary when fruits and some vegetables are eaten raw. Cooking helps in sterilizing the food by killing the germs. The children will be able to understand this idea better if they are asked to carry out the following activities.

Discussion

Why should we wash and sterilize fruits and vegetables before eating?

Ask the children to answer questions like these: How do the fruits and vegetables get contaminated with the germs of diseases? What may happen if the fruits and vegetables are not washed before eating? How can one avoid contracting a disease from the consumption of fruits and vegetables?

Field Observation

How do vegetables get contaminated?

Arrange a trip to a field where a farmer produces vegetables. Take the children to such a place at a time when the farmer has to pluck the vegetables and send them for sale. Encourage the children to observe how vegetables may get contaminated with disease germs. Have a discussion also about the soil and how it may be a source of germs.

Ask the children to talk about the practices that are followed before eating fruits and vegetables in their homes.

Encourage the children to wash the fruits they have brought for school lunch before eating them.

2(b). CUT FRUITS EXPOSED IN A MARKET BECOME CONTAMINATED BY GERMS FROM DUST AND FLIES

One of the common causes of disease is the consuming of exposed and cut fruits. Children are often tempted to purchase such articles of food from a street vendor. These cut fruits are constantly exposed to dust and flies. Dust and flies often carry the germs of disease and thus they are likely to contaminate the food articles. Cut fruits displayed in an open place for ready consumption are very dangerous as they have lost the skin which to some extent affords protection against germs. The children should be made familiar with this important concept through the following activities.

Field Trip

How do exposed and cut fruits get contaminated?

Take the children to a market where cut and exposed fruits have been kept for sale. Encourage them to observe how cut fruits are exposed to dust and flies. Help the children through a discussion to realize that such foods are likely to be contaminated with germs.

Encourage the children to recall an experience of gastric disorder like pain in the abdomen or loose motions, caused by eating cut and exposed fruits.

3. COOKING IMPROVES FOOD IN SEVERAL WAYS

Cooking is the preparation of food by the application of heat. It is a great art and, at the same time, it requires good skill. Cooking should be done in a proper way in order to serve its purpose. We cook our foods for many reasons. Cooking makes the food attractive. It improves its taste. Cooking breaks up the foodstuff, make it softer and tender. This helps in its easy digestion and absorption in the body. Cooking increases the purity of food by destroying the harmful organisms like bacteria and parasites. It is thus sterilized. This also helps the food to keep fresh for a longer time.

3(a). COOKING MAKES SOME FOODS MORE TASTY AND PLEASING

Cooking is useful because it makes the food palatable and pleasing to the eyes. While cooking foods, condiments like chillies and pepper are used. They improve the appearance of food and make it more palatable. The cooked food becomes attractive also because of the physiological changes undergone by the food. The activities suggested below will help the children to understand this idea.

Familiar Experience

How does cooking make some foods more tasty and pleasing?

Ask the children to name some vegetables they usually take at the time of morning or evening meals. Encourage them to tell whether they liked those vegetables and whether they looked pleasing to the eyes or not. Lead them to realize that cooking improves the taste and appearance of food.

Ask the children to find out from their mothers how some foods are made tasty and pleasing by cooking.

3(b). COOKING MAKES SOME FOODS MORE DIGESTIBLE

Cooking makes some foods softer and more digestible. Cooking changes the texture of the food and makes its chewing easier. It would be difficult to digest such foods if they were eaten raw. The activities suggested below will help the children to understand this idea better.

Discussion

How does cooking make some foods more digestible?

Engage the children in a discussion. Would they like to eat uncooked rice? What dangers may arise by eating uncooked rice? How does cooking improve the digestibility of such rice? After the answers are received, lead them to conclude that cooking makes some foods more digestible.

Encourage the children to recall the sad experience of taking on some occasion an item of food not sufficiently cooked.

Ask the children to make a list of foods which are never eaten raw.

3(c). COOKING MAKES FOOD SAFER TO EAT BY DESTROYING HARMFUL GERMS

Food is likely to lose its purity by being infected with germs of diseases. This may happen at the source, or during its storage and distribution. Germs are very small and cannot be seen with the naked eye. The high temperature of cooking kills such disease producing germs with which the food may be infected. This is one of the reasons why many foods should be cooked before eating. The children will understand the idea better if they are invited to do the following activities.

Investigation

How does high temperature preserve food?

Materials required
unboiled milk
pan
source of heat
two containers

Obtain a half-litre of fresh milk which has not been boiled. Boil half of this supply but not the other half. Now put the two samples into two similar containers. Cover each with a piece of paper. Have children examine these samples every few hours for a day or two. Which sample takes longer to curdle and set?

Discussion

How does cooking make the food safer?

Invite children to a discussion on the following lines. How does food get infected? What are the harmful effects of eating infected food? How can we make the food safe by cooking? What foods are usually cooked? Help them to conclude that cooking renders the food safer for eating by killing the harmful germs.

Invite the children to discuss why it is a common practice to boil milk before using it.

3(d). THERE ARE MANY DIFFERENT WAYS OF COOKING

There are various methods of cooking. Cooking can be done by application of dry and radiant heat like roasting and baking or it can be done by the application of moist heat like boiling, and steaming. Fried foods are cooked in oil or fats. Here are some details.

Boiling: The food is brought in direct contact with boiling water. It makes the food digestible but makes it less tasty. A large portion of nutrients is lost when vegetables are boiled and the excess water is thrown away.

Roasting and Baking: Dry heat is used for cooking. Food articles are roasted by exposing them directly to radiant heat. Roasting improves the taste and retains the nutritive value of food. Potatoes, brinjals, meat, etc. can be cooked by roasting. Baking is oven-roasting.

Steaming: It is cooking food by steam from boiling water. It is the best method of cooking as the nutritive value of food is not lost at all. The food cooked by steam is light and easily digestible.

Frying: Food is cooked in hot oil or ghee. It improves the taste. Fried food is slightly difficult to digest. Vitamins are lost by frying.

Cooking is a great art. It also requires skill and proper planning. Different foods are cooked in different ways. Rice is usually boiled before consumption. Bread is prepared out of wheat flour by baking, whereas *puries* are fried with fat. Fish can be fried or steamed. Different methods of cooking employed with different foods are also dependent on the local habits and customs of the community.

The children can be made familiar with the ideas by inviting them to undertake the following activities.

Class Project

Let us cook food for a meal at school

Materials required
assorted food
utensils
stove

Form a committee to arrange for cooking a meal at school. Various children can bring food supplies. Get the help of some of the children's mothers or elder sisters. Arrange for the use of a variety of cooking methods. Have the children do most of the cooking themselves.

Field Observation

Food can be cooked by different methods

Plan for a trip to a nearby boarding school. Arrange for a demonstration of various methods of cooking with the help of the cook of the hostel. Some common articles of food like potatoes, brinjals, green vegetables, fish, can be cooked by different methods.

Ask the children to give illustrations of different methods of cooking from their observations at home.

4. CARE SHOULD BE TAKEN NOT TO WASTE FOOD IN COOKING

While cooking foods, some food value is lost due to faulty cooking. Most vitamins are usually affected by heat. Some vitamins like vitamin C are easily destroyed by heat. Vitamins A and B are unstable at high temperatures. Hence overcooking of such foods which are rich in vitamins should be avoided. Some nutrients like certain vitamins and minerals are soluble in water. Therefore very little water should be used in cooking such food. If water is used in excess and the water is thrown away after cooking, the cooked food will be poorer in these nutrients.

4(a). COOKING DESTROYS CERTAIN VITAMINS; OVERCOOKING SHOULD THEREFORE BE AVOIDED

Some vitamins are affected by heat. Vitamin C is easily destroyed by heat. Vitamin A and vitamin B are not stable at high temperatures. Hence care should be taken while cooking foods rich in such vitamins. Overcooking of such food should always be avoided. Some common examples of such foods are green leafy vegetables, tomato, cauliflower, carrots, milk, egg yolk. The children may be encouraged to do the following activities in order to make them understand the idea better.

Discussion

Why should we avoid overcooking?

What is the effect of heat on vitamins? Which of the vitamins is easily destroyed by heat? What foods usually rich in vitamins are affected by heat? What precaution should be taken while cooking such foods. Ask the children to reply to such questions. Lead them to understand why overcooking should be avoided.

Ask the children to draw some pictures of foods rich in a particular vitamin which is most easily destroyed by heat.

4(b). CERTAIN MINERALS AND VITAMINS ARE DISSOLVED IN COOKING WATER

Some vitamins like vitamin B and vitamin C and minerals are soluble in water. Because of their solubility in water, these vitamins and minerals are liable to be lost through faulty cooking. If vegetables and cereals are soaked in water for a long time, the vitamins are lost if the water is discarded. If rice is boiled in excess water and then the water is thrown away, it loses some food value. Hence food should be heated with water just sufficient to meet the needs of cooking. Here are some activities which can help the children become familiar with this important concept.

Investigation

How does cooking with excess water diminish food value?

Materials required
apples
pan for cooking
source of heat
straining cloth
tumbler

Cut two or three apples into small pieces. Use an excess amount of water

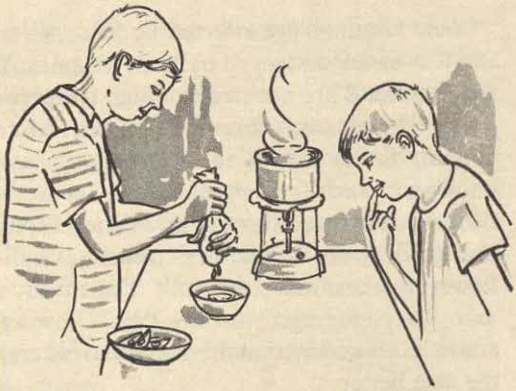


Fig. 10-13
Boiling with water extracts some nutrients from the food.

to boil the apples for 20-30 minutes. Now strain the apple pieces out while the liquid goes into a clean tumbler as in Fig. 10-13. Allow some children to taste the liquid. It tastes fine! Discuss with the class how in a similar way food is lost in water used for cooking. Help them realize that this loss can be reduced in two ways. Cooking can be done with less water. Also, it is useful to drink the liquid in which food is cooked, or to use it in some other way.

Discussion **Why should we not use excess water in the cooking?**

How much water should be used in cooking the food? Is there any bad effect if the excess water is thrown away? Why does food lose its nutritional value by the use of excess water? What nutrients are lost due to use of excess water while cooking and rejecting the excess water later? Guide the children through these questions to understand the wastage in using excess water for cooking.

Encourage the children to describe the practice followed in their homes for cooking rice. Is the excess water thrown away?

5. FOODS NEED TO BE PROTECTED AND PRESERVED

All people have a responsibility—a part to play in the job of food preservation. This is necessary particularly in view of the existing food shortage in the country. In fact, much food is wasted in India due to many reasons which should be avoided. Food grains, vegetables and fruits are spoiled by insects, rodents and vermins. Unsuitable moisture conditions, the activities of organisms like bacteria and yeast, temperature conditions, light and air are also responsible for food spoilage. Foods should be stored in such a way that they can be retained for a long period without any change in their quality. This is possible if foods are stored, keeping in view certain principles of food preservation. Foods can be preserved by storing them at low temperatures, or in air-tight containers, by boiling or salting and by use of sugar syrup. Cooked food also needs to be protected against harmful organisms.

5(a). VARIOUS AGENCIES SPOIL FOOD GRAINS, VEGETABLES AND FRUITS

Various agencies are responsible for spoilage of food grains, vegetables, and cereals. One of the main causes of wastage of food is damage by insects and rodents. Cereal crops are often totally destroyed by locusts. A large quantity of food grains is eaten and spoilt by rats. Bacteria and yeast are some other living organisms responsible for food spoilage. Bad conditions of temperature damage foods such as fruits by changing the physical state of the food or enhancing the activity of enzymes and bacteria. Vegetables get dried and spoilt due to change in the moisture content. Improper storage, inability to use left-overs, and failure to utilize all portions of food are other factors which lead to wastage of food. Here are some activities which can help the children to understand these ideas better.

Field Observation **How do rats spoil cereals?**

Take the children to a farmer's house. Ask them to see the arrangements made to store the cereals produced by the farmer. Encourage the children to observe how much cereals have been spoilt by rats. Discuss with them how much food is wasted in this manner every year.

Familiar Experience **How do potatoes get spoilt by bacteria?**

Encourage the children to recall how some potatoes get spoilt easily in the rainy season in the home due to growth of bacteria. The spoilt potatoes are quickly screened by their mothers in order to avoid the rest of the potatoes getting spoilt. Help them to realize what a tremendous waste occurs due to lack of proper storage facilities with the farmer.

Discuss with the children how fruits and vegetables get spoilt in the homes and what their mothers do with them.

Take the children to a market and encourage them to observe how wastage of food occurs and discuss with them the causes.

5(b). STORING AT LOW TEMPERATURES PRESERVES FOOD

Preservation of food is essential to prevent waste occurring in many ways. If food is kept stored at low temperatures, it can be kept for a longer period without altering its natural qualities. Enzyme activity and the growth and multiplication of bacteria are prevented by cooling. This principle is taken advantage of in the refrigerator, a modern device, often seen in urban homes, for the preservation of food. The activities suggested below can help the children become familiar with this idea.

Discussion

How can we preserve food by storing at low temperatures?

Can the food be preserved for a longer time in winter than in summer? If so, can you state the reason? Can you give an example of some foodstuff stored at temperatures lower than that you often come across? Do you think that this principle can be used in any way for food preservation? Help the children to realize through these questions that food can be preserved by storing at lower temperatures.

Take the children to a fish market. Encourage them to observe fish kept covered under ice.

Arrange a visit to a cold storage, if there is one nearby.

Discuss with the children how an icebox can be of domestic use for preserving food.

5(c). STORING IN AIR-TIGHT CONTAINERS HELPS PRESERVE FOOD

Food should be stored in tightly covered containers. Air should not pass through the covers. By this method, foods can be preserved for a longer time. The air-tight container prevents foods from being spoilt through moisture. It also prevents contamination with germs from outside. Air-tight containers are used in canning. The activities suggested below will help the children to understand the idea better.

Discussion

Engage the children in a discussion. What is an air-tight container? Can you preserve food by storing it in air-tight containers? How do air-tight containers help in the preservation of food? What food articles can be stored in such a way?

After the answers are received, help them to realize that foods remain unspoiled longer if stored in an air-tight container.

Ask the children to name some common food articles kept stored in air-tight containers.

Take the children to the market to show the different types of canned foods available there.

For Better Understanding

It is helpful to store foods like pulses, dried fruits, and flour in a container with a tight-fitting lid. If it is truly an air-tight container, moisture and dust and germs will be kept out. However, food stored in this way will keep good only for a limited time. When foods are commercially canned, the food is literally sterilized by temperatures often well above 100° C. Then the lid is sealed on so that the container is absolutely air-tight. If the food is truly sterile, and if the container is absolutely air-tight, the food will keep from spoiling almost indefinitely. No refrigeration is needed for food preserved in this way.

5(d). SALTING PRESERVES FOOD

Another convenient method of food preservation is to mix the food article with common salt. The salt with water from the food-stuff forms a concentrated solution. Germs cannot live in such a solution. Salting is practised for preserving meat, fish and vegetables. The children can be made to understand the idea better through the following activities.

Familiar Experience

Does salting preserve food?

Remind the children of pickles of mangoes, lemon, etc., prepared in the homes. Encourage them to ask their mothers how they are preserved. Common salt is used as a preservative here.

Ask the children to name a few food articles which are preserved by salting.

5(e). BOILING PRESERVES FOOD

Boiling is another method which helps in preservation of food. This method is commonly adopted in the homes of this country in the case of milk. Boiling destroys all enzymes and micro-organisms responsible for food spoilage. The children can be made familiar with the idea if they are helped to do the following activities.

Investigation

How does boiling preserve food?

Materials required
stove
two vessels
milk

Take some milk in two vessels. Ask one of the children to boil the milk in one vessel over a stove for a few minutes. Leave the milk in both the vessels open to air. Let the children observe the milk for several hours. The unboiled milk will spoil much sooner than the boiled one due to growth of bacteria.

Encourage the children to discuss with their mothers how curries prepared in the morning are sometimes brought to use in the night.

5(f). KEEPING IN SUGAR SYRUP PRESERVES FOOD

Another practice that is followed for preservation of food is to keep the food in sugar syrup. The sugar syrup draws so much water from the bacterial cell that the cell actually sinks and dies. Thus the growth of bacteria is prevented. Various jams prepared in this way retain their quality for a long time because of the concentrated solution of sugar. The activities suggested below can help the children to understand the idea better.

Familiar Experience

How does the use of sugar syrup preserve food?

Remind the children of the usual jams that are prepared in the homes. Encourage the children to talk to their mothers to know how they are prepared. The jams are preserved by the sugar syrup.

Field Observation

How are sweets preserved?

Take the children to a sweetmeat shop. Encourage them to observe how different sweets are preserved by the use of sugar syrup.

Point out that although foods seldom spoil in syrup because of bacteria, they are sometimes spoiled because of yeast or mold.

Ask the children to name a few articles of food that are preserved by keeping them in sugar syrup.

5(g). COOKED FOOD SHOULD BE PROTECTED AGAINST BACTERIA, YEAST AND MOLD

Foods once cooked do not remain free from germs for ever. In cooked foods disease producing organisms like bacteria, yeast and mold may grow if these are allowed entrance from outside. Cooked foods may become infected if they are kept exposed to dust and flies, handled by dirty hands, mixed with impure water or stored under improper conditions. Hence care should be taken to protect cooked foods from harmful organisms. The activities suggested below can help the children to become familiar with this important sub-concept.

Familiar Experience

How should cooked foods be protected ?

Encourage the children to recall how some cooked food got spoilt in their homes. Ask them to state the reason why such foods are thrown away by their mothers and not used for eating. What is the cause of such spoiling ? How can it be prevented ?

Ask the children to bring some curry to the class and leave it open. Encourage them to observe it for a day or two.

Scientists at Work

How useful it is to be a food scientist

Food is the basis of all life. No growth is possible without food. Meeting the needs of food is as important for the growth of a nation as for the survival of a person. The prosperity of a country is easily judged by the quantity and quality of food its people take. There should be food for all; and it should be nutritious and plentiful. Considering the great importance of food in national life, our government opened the Central Food Technological Research Institute at Mysore in 1950. Today we will be talking about this institute.

The Central Food Technological Research Institute is one of the many research laboratories in India functioning under the Council of Scientific and Industrial Research. The Institute is housed in a large building, given by the Government of Mysore to our late Prime Minister Shri Jawaharlal Nehru in 1948. The Institute was declared open by Shri Rajagopalachari in 1950.

You might like to know what this Institute tries to do. Its main objectives are:

1. To prevent incidence of heavy losses of food grains and perishable foods.
2. To assist food processing industries in their development programmes.
3. To develop new processes of converting Indian raw materials into low-cost food products.
4. To undertake long range research to develop food science and food technology.

Let us now see how scientific research at the Institute has served our country.

The Institute has helped the Indian cold storage industry by investigating the best conditions of temperature and humidity for storing food. Work has also been done on quick-freezing of various types of fruits and vegetables. Moreover, a mold-killing wax has been prepared from the wastes of the sugar-cane industry. Fruits and vegetables coated with this material can be stored for a much longer period without spoiling. The Institute has also developed a technique for preparing food from a blend of mango-pulp, wheat flour and sugar. The product is similar to corn flakes. The process helps in economical utilization of mangoes.

Some of the most interesting results of the research work at the Institute are in the field of new food products. A typical Indian diet does not have enough proteins. Yet proteins are very necessary for healthy growth. The Institute has developed several protein-rich foods. 'Edible quality ground-nut flour' is prepared from ground-nut meal—a product left after extracting oil from ground-nuts and often used as cattle-feed and manure. The Central Government and many states are taking keen interest in the manufacture of ground-nut flour. UNICEF has donated two plants for its manufacture.

Another protein-rich product developed at the Institute is 'Indian Multipurpose Food'. It is prepared by mixing three parts of ground-nut flour and one part of Bengal gram flour and adding vitamins and minerals to the mixture. The product is inexpensive and very good for overcoming the deficiency of protein, minerals and vitamins in typical Indian diet.

The Institute has developed a process for the manufacture of 'baby food' from buffalo milk. The Institute has also prepared new varieties of 'precooked, dehydrated and ready-to-eat foods' for the army. These are lightweight, high-energy-giving and easily assimilated.

You see how important scientific research is for devising new types of foods and preventing a great deal of waste in food. Moreover, by devising human foods from materials that were formerly used as manure or animal food, the scientific research has added new sources of food materials.

How useful it is to be a food-scientist!

TEETH

1. GOOD TEETH ARE USEFUL TO MAN IN MANY WAYS

Good teeth serve many useful purposes. They are necessary for the proper digestion of food. Teeth aid in digestion, first by breaking up food into small pieces, and secondly, by stimulating the flow of saliva in the mouth. Saliva breaks starchy food into sugars. A set of clean and good teeth adds to the personal appearance of an individual. We owe our proper facial expression to the presence of teeth. Teeth are used in the articulation of certain sounds. We cannot speak clearly without the teeth. Hence teeth are precious possessions; every person should give special care to his teeth.

1(a). GOOD TEETH ARE NECESSARY TO CHEW FOOD THOROUGHLY

A person enjoys good health if he has a set of good teeth. Teeth help in chewing foods thoroughly. Chewing has two helpful effects in relation to the digestion of food. It breaks the food into smaller particles. This saves the stomach from unnecessary action. If the food is swallowed without chewing, it puts a heavy strain on the stomach to digest it. Chewing stimulates the flow of saliva in the mouth from the three pairs of salivary glands. Saliva is a colourless fluid which contains an enzyme known as ptyalin. With the help of the enzyme, starch is broken into sugar. The tongue and cheeks help in moistening the food with saliva. The food is thus easily crushed by chewing it properly with the help of teeth. Children who have defective teeth cannot chew their foods thoroughly. This delays the process of digestion. Here are some activities which can make the children understand the idea better.

Discussion | **How do good teeth help in easy digestion?**

Is it necessary to chew the food thoroughly for digestion? How does chewing help in the digestion of food? Why do you think that good teeth are necessary? Help the children to realize through these questions that good teeth are necessary for the easy digestion of the food.

Allow the children to talk to an old person who does not possess good teeth.

1(b). TEETH GIVE EXPRESSION TO THE HUMAN FACE AND MAKE CLEAR WHAT WE SPEAK

It is known that teeth help in the digestion of food. Apart from the health point of view, teeth have other important functions. Teeth contribute towards the facial expression. Teeth help in speech. The following activities can make the children become familiar with these ideas.

Investigation | **Can we speak clearly without using the teeth?**

Ask the children to utter a few words without allowing the tongue to touch the teeth. Encourage them to find out if they are able to pronounce the words clearly.

Allow the children to observe the facial expression carefully when talking to a person who has lost several teeth. The person lacks real expression and is unable to speak clearly.

2. THERE ARE DIFFERENT TYPES OF TEETH

The teeth can be classified into two different ways :

a. Depending on the functions performed, the teeth are of different types. There are the incisors for biting or cutting, the canines for tearing, and the molars for grinding and masticating the food.

b. A man grows two sets of teeth during his life. A set of small teeth appears during the infancy. This is replaced in later childhood by a more or less permanent set of teeth. This set lasts through adult life.

2(a). THERE ARE THREE BASIC KINDS OF TEETH

There are different types of teeth depending on the functions they serve. The front teeth used for cutting off pieces of food are called the incisors. They are flat and sharp-edged. The canine teeth are used for tearing food. They are more prominent in animals like cats, dogs and tigers. The canine teeth are long, narrow and fang-like. They are placed at each side of the incisors. The molar teeth are used for grinding food. They have rough, flattened surfaces. They are situated at the back of each half-jaw. The activities suggested below can help the children to understand better the functions of the different kinds of teeth.

Investigation | **How do we use different teeth for different functions?**

Ask the children to bring a *chapati* for their school lunch. Ask them to cut, tear and grind a piece of the *chapati.* Encourage them to observe how different kinds of teeth are used for the purpose. Let them state the function of the different teeth.

Ask the children to make a drawing of each kind of tooth they possess.

2(b). DURING A NORMAL LIFETIME, EACH PERSON HAS TWO SETS OF TEETH

Each human being has two sets of teeth for his whole life. The first set of teeth are temporary or milk teeth. These are replaced later by a permanent set. The temporary teeth begin to appear when the child is about six or seven months old. The lower incisors usually cut the gum first. The upper incisors appear at about the age of ten months. The first molars come out at about fifteen months. These are followed by the canines. The final molars appear when the child is two years old. The milk teeth number twenty. There are four incisors, two canines and four molars in each jaw, upper and lower. See Fig. 10-14a.

Permanent teeth begin to appear when a child is about six years old. The first permanent tooth to appear is usually a molar. This tooth comes out next to the temporary molars. Other molars come out gradually as the jaw-bone grows longer. The permanent teeth number thirty-two. There are four incisors, two canines, four pre-molar or bienspids, six molars in the permanent set in each jaw. Pre-molar teeth are small grinding teeth not present in the milk set. See Fig. 10-14b. Here are some activities which can help the children become familiar with the idea.

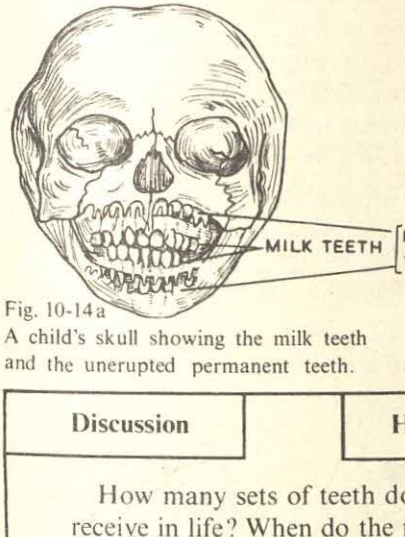


Fig. 10-14a
A child's skull showing the milk teeth and the unerupted permanent teeth.

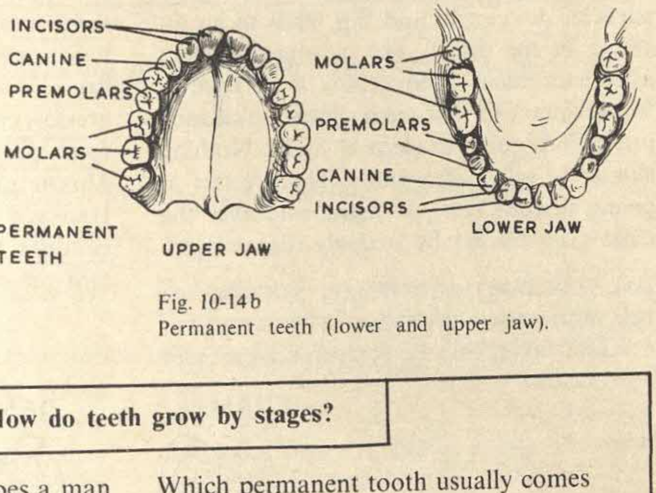


Fig. 10-14b
Permanent teeth (lower and upper jaw).

Discussion | **How do teeth grow by stages?**

How many sets of teeth does a man receive in life? When do the milk teeth begin to appear? How many milk teeth does a child have? At what age do the permanent teeth begin to appear? Which permanent tooth usually comes out first? Guide the children through these questions to realize that teeth grow in two stages.

Encourage the children to observe the mouth of a baby to see in which order the teeth appear.

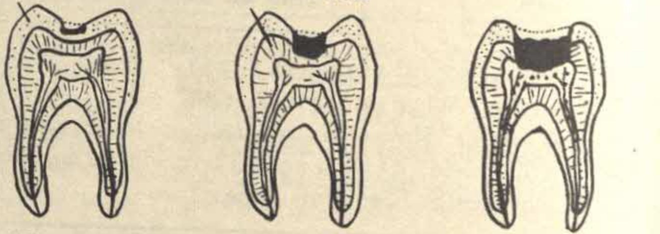
Ask the children to take a mirror and look at their teeth. Let them count them. Do any of the children still have milk teeth?

3. TEETH DECAY IF THEY ARE NOT KEPT CLEAN

Proper care should be taken to keep the teeth clean. In fact, teeth should be cleaned both before and after taking food. Food particles should not be allowed to remain beween the teeth. They are decomposed easily by the bacteria in the mouth. As a result of this decomposition, various injurious substances are formed. For example, acids produced in this way corrode the teeth. The decay of teeth proceeds further, more food particles get caught and this leads to an increase in the decay. The cleaning of teeth after each meal removes any food particle from the mouth. The teeth should be cleaned just before going to sleep at night. Nothing should be taken afterwards. The practice of giving biscuits, etc., at night whenever the child cries should be strongly discouraged.

3(a). FOOD PARTICLES, IF LEFT STICKING TO THE TEETH, LEAD TO DECAY OF THE TEETH

While taking meals, some food particles get stuck between the teeth. If these are not removed, they begin to decompose by the action of bacteria present in the mouth. The conditions provided within the mouth are suitable for the rapid growth and multiplication of bacteria. As a result of this, acid formation takes place. The acid attacks the enamel, which is the thin outer layer of very hard material covering the exposed portion of a tooth, as shown in Fig. 10-15. This is made mainly of lime. The acid dissolves the lime and thus eats into the enamel and causes decay. As the decay of the teeth progresses, cavities are formed in the teeth. More food particles are caught in the cavities. This in turn causes further decay of the teeth. Here are some activities which can help the children become familiar with this important sub-concept.



(a) ENAMEL HAS STARTED DECAYING

(b) DENTINE HAS ALSO BROKEN DOWN

(c) PULP CAVITY IS AFFECTED RESULTING IN INFLAMMATION AND PAIN

Fig. 10-15
In a decayed tooth the enamel is worn away and even inner tissues may be affected.

Investigation

What is the condition of teeth after eating?

Materials required
chapati or other starchy food

Select a child who has carefully cleaned his teeth since the last meal. Allow him to show his teeth to others. Now let him eat some starchy food and chew it well. Once again he can permit others to examine his teeth. Can they see food particles between the teeth?

Discussion

What causes dental decay?

What happens if food particles are left sticking to the teeth? Where do the bacteria come from? Which injurious substances cause the decay of teeth? How does cavity formation takes place? Guide the children through these questions to understand that food particles, if allowed to lodge in between the teeth, lead to dental decay.

The reports of dental check-up of the children, if any, may be read and discussed.

A case of dental decay spotted by the teacher among the children may be demonstrated in the class.

3(b). TEETH SHOULD BE CLEANED BOTH BEFORE AND AFTER TAKING FOOD

Teeth must be cleaned both before and after each meal. Cleaning teeth before meals makes the mouth fresh and removes any dirty material. Cleaning teeth after meals removes any food particles collected between the teeth. Foods, specially starch and sugar, if allowed to remain, putrefy. This emits a foul smell from the mouth and also leads to the decay of teeth. Children should form a regular habit of cleaning the teeth both before and after taking food. The activities suggested below can help the children become familiar with the idea.

Class Project

We should clean our teeth both before and after taking food

Encourage the children to clean their teeth both before and after taking their school lunch every day. This needs to be observed and checked up by the teacher. If any child is found not to follow this practice, he should be helped to understand why the practice is so essential for good teeth.

Ask the children to maintain a diary regarding their teeth cleaning.

3(c). MASSAGE OF THE GUMS AIDS IN KEEPING THEM HEALTHY

After cleaning the teeth, one should massage the gums several times with the help of the forefinger. The massage helps in improving the circulation of blood through the gums. This keeps the gums healthy. This healthy practice should be followed regularly. The children can be helped to understand the idea better by encouraging them to do the following activities.

Demonstration

How does massaging keep the gums healthy?

Let the children be given a demonstration as to how to massage the gums, by the teacher in the class. Discuss with them the usefulness of this practice.

Arrange to have a local doctor, dentist, or District Health Officer come to the school and talk to the students about dental hygiene.

4. DECAYING TEETH CAUSE DISEASE AND PAIN

Dental decay may lead to indigestion, dyspepsia and other stomach troubles. The food particles cannot be properly chewed. Also, the decaying teeth form sores in the mouth and infected material is thus swallowed from time to time. The acid formed by the organisms which cause tooth decay attack the enamel of the teeth which gets gradually corroded. When the nerve tissue becomes involved in the process of erosion of teeth it causes severe toothaches. Study Fig. 10-15.

4(a). BAD TEETH GIVE RISE TO INDIGESTION AND STOMACH TROUBLES

If the teeth are bad, food is not chewed properly, but is swallowed in lumps. Foods are neither broken into pieces, nor thoroughly mixed with saliva in the mouth. As the process of digestion in the mouth does not take place the person has indigestion. Usually bad teeth become storehouses of germs and rotten food. Infected material from this focus may be swallowed from time to time. This leads to stomach trouble. Suggested below are some activities which can help the children to understand the idea better.

Discussion

How do bad teeth lead to indigestion and stomach trouble?

Engage the children in a discussion. Do bad teeth give rise to indigestion.

Why does this happen? Do bad teeth have any effect on the stomach? If so, what is the effect? After the answers are received, lead them to realize the effect of bad teeth on the digestion and the stomach.

Ask the children if they have had tooth decay and if they can remember the bad taste which this causes in the mouth.

4(b). BAD TEETH CAUSE A FOUL SMELL

When teeth begin to decay, cavities are formed in the teeth. Food particles may remain collected in the cavities, and begin to rot. This gives rise to a foul smell. Sometimes, in the absence of proper care of teeth, a disease of the gums may develop. The disease is common in adults but it may occur in children also. The gums become soft and flabby. Teeth become loose and pockets form near the root of the teeth. Food collects in such pockets and rots, forming pus. This also causes a foul smell. This disease is known as pyorrhoea. The children may be helped to become familiar with the idea through the activities suggested below.

Investigation **How do bad teeth cause a foul smell?**

Select a child who emits a foul smell from the mouth. Ask the children to examine the condition of the teeth of the child. Let someone press the gums of the child also. Often decaying teeth or infected gums will be seen. Encourage the children to discuss the cause of the foul smell.

Ask the children to draw a diagram showing a tooth with a pocket formation, and the gum and part of the jaw.

4(c). DECAY OF TEETH LEADS TO TOOTHACHE

When teeth begin to decay, the process starts by attacking the enamel of the teeth. When the inner tissue called dentine is involved, the tooth begins to hurt if very hot or cold liquid is taken.

As the decay proceeds further, the pulp cavity inside the dentine which contains the nerves is affected. This causes a severe toothache. One should be careful therefore not to neglect the early stage of dental decay. Here are some activities which can help the children become familiar with this important concept.

Investigation **How does tooth decay lead to toothache?**

Find a child who has a toothache. Ask the children to examine the affected tooth. Usually the decay of teeth will be visible. Encourage the children to realize that decay of teeth leads to toothache.

Let the teacher spot out the decayed teeth of the children while doing morning inspection and guide them accordingly.

MICROBES

1. MICROBES ARE MICROSCOPIC LIVING THINGS

Microbes are extremely small living organisms. They are too small to be seen with the unaided eye but can be seen or studied with the help of a special instrument called *microscope*. They are present almost everywhere, in air and on the surface of common objects. As microbes effect man's living in many ways it is interesting and important to learn about living things in the microscopic world.

1(a). MICROBES ARE TOO SMALL TO BE SEEN WITH THE NAKED EYE

Microbes are extremely small. They are so small that they can be seen only with a microscope. This instrument makes things look many hundreds of times larger than they actually are. The activities suggested below can help the children become familiar with the concept.

Discussion

Microbes are too small to be seen with the naked eye

Involve the children in a discussion. Are microbes extremely small? How small a thing can be seen with the naked eye? What is the average size of bacteria? Help the children to realize through these questions how small microbes are. Ask them whether they will be able to see such small organisms with the naked eye. Viruses are much smaller than bacteria. (The average diameter of one bacteria is about one-thousandth of a millimeter).

Arrange for the children a demonstration of some bacteria seen under a microscope from a local clinic or a health centre.

Discuss with the children and help them to visualize the size of the microbes by the following statement: About ten thousand *million bacteria would be required to weigh 1 milligram.*

1(b). MICROBES ARE FOUND EVERYWHERE IN THE AIR, WATER AND SOIL

Microbes are present everywhere. They are present in the air, in the water, in the soil and upon all surfaces, and on all living things. It is virtually impossible to escape from the microbes. Man has been constantly trying to fight back effectively against these microscopic enemies. Fortunately, however, many microbes are harmless. The activities suggested below can make the children realize that the microbes are present almost everywhere.

Investigation **Where can microbes be found?**

Arrange a trip to a local health centre or a private clinic. Place a drop of water from a stagnant ditch on a glass slide. Ask the children to observe it under a microscope. A number of small living organisms, e.g., bacteria, will be seen.

Ask the children to draw diagrams of different microbes. Lead them to conclude through a discussion that microbes are present everywhere.

1(c). MICROBES GROW VERY RAPIDLY UNDER SUITABLE CONDITIONS

Like other forms of life, microbes have certain living requirements. When these are met, the microbes are able to survive and grow fast. The first thing that the microbes require for their growth and multiplication is proper food. Vegetable and animal matter provide good food for them. The microbes derive their nourishment from such matter. If the food is in liquid or semi-solid condition, it provides better nourishment for the microbes.

Moisture is another important thing that must be supplied for the growth of microbes. Most of the microbes grow in the presence of oxygen, although some of them can live without it also.

All microbes are affected by temperature. There is a minimum temperature, a maximum temperature and an optimum temperature at which microbes grow best. However, most microbes grow best at warm temperatures ranging from the room temperature to the body temperature. Here are some activities which can help the children to understand the various growth requirements for the microbes.

Investigation **Under what conditions do microbes grow best?**

Materials required
potato
knife

Encourage the children to grow some bacteria in the following way.

Cut a piece from the inside of a large potato. Expose it to the air in a damp, warm place for several days. In this way food, moisture, oxygen and temperature are provided. Ask the children to describe what happens.

Discuss with the children the growth requirements of the microbes.

1(d). THE COMMON KINDS OF MICROBES INCLUDE BACTERIA, PROTOZOANS, MOLDS, YEAST AND VIRUS

There are many, many living things too small to be seen with the unaided eye. Only the most common types are considered here.

Bacteria. They are one-celled micro-organisms having no chlorophyll. They are of two main types, spherical—the cocci, and rod-shaped—the bacilli.

They grow rapidly under suitable conditions and cause diseases like tuberculosis, pneumonia, cholera and typhoid.

Protozoa. They are one-celled organisms much larger than bacteria. They cause malaria, amoebic dysentery, etc.

Yeast. These are one-celled organisms which reproduce by budding. They are needed for alcoholic fermentation; for example, baker's yeast, common wine yeast.

Mold. It is a many-celled plant growth, e.g., bread mold.

Virus. It is the smallest form of life known. Viruses cannot even be seen with an ordinary microscope. Influenza, small-pox, and common colds are caused by virus.

Activities such as those which follow can help the children to get a better understanding of microbe life.

Investigation **How can we grow some microbes?**

Ask the children to grow some microbes in the following way:

a. Keep some milk open in the air. Let the children observe the various changes taking place due to growth of bacteria.

b. Collect a piece of orange peel. Expose it to the air in a damp place. Let the children observe the growth of molds.

Help the students make for the class a chart showing the different kinds of microbes.

2. SOME MICROBES ARE USEFUL TO MAN; AND SOME ARE HARMFUL

There is a popular belief that all the microbes are harmful to man. This is not true. Some bacteria render useful services to mankind. Bacteria assist in the production of curd from milk and in making the soil fertile for agricultural purposes. Some bacteria convert the decaying organic waste into a useful plant food. However, many bacteria are harmful to man. Some bacteria putrefy food and make it impure. Some microbes are responsible for various diseases in human beings.

2(a). SOME BACTERIA ARE USEFUL

It is not correct to form the impression that all bacteria are harmful. Indeed, many bacteria are quite useful and essential to man. They are like the bacteria which curdles the milk. The curd provides the nutrition and, at the same time, it helps in the digestion of food. Within the soil, some bacteria convert manure into useful plant food and thus make the soil fertile. Most of the decay of plant and animal matter is brought about by bacteria which convert the material into an odourless plant food. Thus the waste material is brought into circulation again and used by the new generation of living things. Here are some activities which can help the children to become familiar with the idea that some bacteria are useful.

Familiar Experience **How do bacteria help in making curd?**

Encourage the children to recall how curd is prepared from milk in the home. The curd is a useful and palatable food; it is formed by the action of bacteria on milk.

Class Project **Let's make a compost pile**

Encourage the children to construct a compost pit. Ask the children to fill in the pit with vegetable peelings, skins of fruits, leaves, grass, and straw. Instruct them to cover the pit with earth. Let them wait for about four to six months and see what happens. The resulting fertilizer is very good for the soil.

2(b). SOME BACTERIA DESTROY FOOD

Some bacteria are harmful to man. When food is kept for some time without using any method of preservation, bacteria start the decomposition of the food. The food so decomposed changes its characteristics. It has a foul smell and is unfit for eating. A lot of food-stuff is thus wasted daily. Here are some activities which can help the children to understand the idea better.

Discussion **How is food spoiled by bacteria?**

Are some bacteria harmful? How do some bacteria putrefy food? What dangers may arise by consuming rotten foods? Guide the children through these questions to realize that some bacteria cause decomposition of food and make it unwholesome.

Ask the children to explain why foods like fish, meat or vegetables, if found to be rotten in the homes, are thrown away by their mothers.

Encourage the children to recall that the rotten food-stuff kept for sale by vendors is sometimes seized and taken away by the municipal health authorities.

2(c). SOME MICROBES CAUSE DISEASES

Some microbes like bacteria are responsible for causing diseases such as cholera and typhoid in man. There are specific microbes which cause specific diseases. When these microbes are transmitted from a sick person to a healthy individual, the latter gets the disease. The microbes may gain entrance to the body of a healthy individual through various agencies. Here are some activities which can make the children become familiar with this important idea.

Interview

What diseases are caused by microbes?

Take the children to a local doctor. Encourage them to discuss with him how diseases are caused and if some microbes are responsible for diseases like cholera and typhoid.

Ask the children to state the reason for medical examination of the stool and vomit of a person who is ill. This is done to find out which microbes have caused the illness.

Encourage the children to discuss why the drinking water is first boiled when a typhoid case occurs in a family.

UNIT 10

HUMAN BODY, HEALTH AND HYGIENE

CLASS V

Overview

The children have learnt in class III that the human body works somewhat like a machine. This is true in the sense that many of its organs *coordinate* to perform a specific function, e.g., digestion of food, circulation of blood, removal of wastes. The children were then too young to understand how different parts of the body work together. In class V of this unit, the role of the nervous system in coordination and control of body functions is introduced in an elementary way.

In order to understand how a machine works, one must first know its parts. With that aim in view, the *three systems* (central, peripheral and autonomic) of the nervous system have been described in the first major concept. The different functions of the nerves have been described in the second major concept. One of the sub-concepts discussed here is about the use of the nervous system to enable the person to *adjust* to environment. The concept of adjustment is very important for the discussion of the four major concepts which follow.

Adjustment starts with perceiving (i.e. seeing, hearing, smelling, etc.) a specific situation in the environment. It may be, for example, seeing a snake creeping or hearing a dog bark. The human body perceives these situations by sensory organs: eyes in the first case and ears in the other. These two sensory organs have been dealt with in the third major concept.

Nerves carry the information gathered by sensory organs to the brain. In this way they serve as message carriers for the brain which may be regarded as 'General Headquarters' for the operations of the body. Other nerves carry back the orders from the brain to the muscles and glands. The resulting movements of the body are accomplished by bones, muscles, joints, ligaments and tendons. These parts of the body have been described in the fourth, fifth and sixth major concepts.

The last three major concepts (7, 8 and 9) deal with some diseases that are caused by micro-organisms and then carried from one person to another very rapidly. These infectious diseases, e.g., cholera, malaria, bubonic plague had been very dreadful for human society until about 150 years ago. This was because their causes were not known. Nobody then knew why these diseases spread so rapidly. This has been discussed in seven sub-concepts in the eighth major concept. The nervous system, the movements of the body, and the nature of communicable diseases—these are the three big areas of learning in this unit in class V. Once these materials are understood, students will be ready to undertake the learning of more advanced concepts in the middle grades.

1. THE NERVOUS SYSTEM IS MADE UP OF THREE SUB-SYSTEMS

The nervous system is the most complicated system of the body. It controls all other systems in the body and ensures their smooth working. All activities are directed and controlled by the nervous system. The beating of the heart, the movement of the intestines, the maintenance of blood pressure, and all other activities which occur automatically or through volition, are under the influence of the nervous system. The nervous system is a highly organized one. It consists of three sub-systems:

a. the central nervous system
b. the peripheral nervous system
c. the autonomic nervous system

The sub-concepts which follow are intended to help students build up a meaningful understanding of this broad concept.

1(a). THE CENTRAL NERVOUS SYSTEM CONSISTS OF THE BRAIN AND THE SPINAL CORD

All human movements and sensations are controlled by the nervous system. To understand clearly the activities of this complex system, it can be conveniently classified into three sub-systems. One of these is called the central nervous system or the cerebro-spinal system. See Fig. 10-16 a, b. This consists of the brain and the spinal cord.

The Brain. It is a mass of nervous tissue well protected within the cavity of the skull. The human brain weighs a little less than one and a half kilograms. The brain is well protected from jerks and bumps, since it is surrounded by a cushion of liquid. There are four main parts of the brain.

a) *The Cerebrum*. This is the largest part

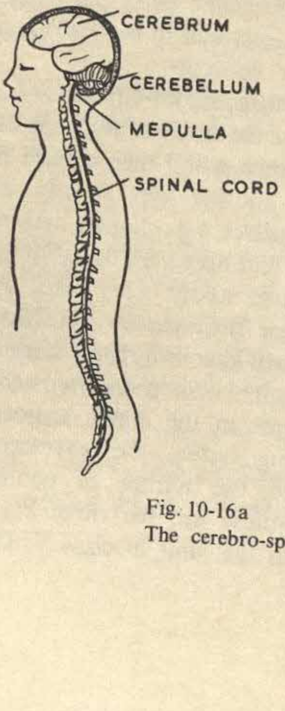


Fig. 10-16a
The cerebro-spinal system in man.

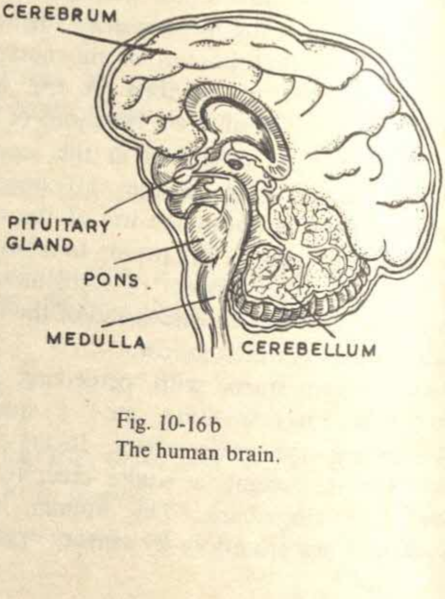


Fig. 10-16b
The human brain.

of the brain. It consists of nerve cells and fibres. The various centres responsible for different activities are located in this part of the brain. Each centre is meant for a particular activity. It is these centres which enable one to think, to remember, to control voluntary movement and to change emotions like love, hate, fear, joy, anger.

b) *The Cerebellum.* This is situated below the cerebrum at the back of the skull. It helps to maintain balance and posture. Precise movements of the fingers or the limbs would be impossible without the cerebellum.

c) *The Pons.* This is mostly made up of nerve fibres which either ascend to the cerebrum or descend from it. It is a bridge between the cerebrum and the medulla oblongata.

d) *The Medulla Oblongata.* This lies under the pons and rests on the floor of the skull. It consists of nerve cells and fibres. It controls some vital functions of the body like the beating of the heart, the circulation of the blood and respiration.

The Spinal Cord. This is a slender, white, soft bundle of nerve fibres. It lies in a canal formed by the hollows in the vertebrae. This position protects the spinal cord from any shock or mechanical injury. The spinal cord is about 1.35 cm in diameter. It acts as a two-way conducting path for sensations (stimuli and responses). It receives sensory and other impulses from the various parts of the body and carries them to the brain. It also transmits the orders that are received from the brain for their execution to the different parts of the body. The spinal cord also carries out reflex actions. A reflex action is an activity carried out spontaneously without involving conscious thought. A good example is the quick withdrawal of the foot when it is pricked by a thorn.

Here are some activities which can help the children become familiar with the functions of the central nervous system.

Investigation

Does the cerebrum receive sensation of touch?

Materials required
coin

Ask the children to close their eyes. Place a coin in their hands. Encourage them to tell the nature of the coin, e.g. whether it is a 50 paise coin or 25 paise coin or 10 paise coin. Guide the children to realize that the impulses of touching the coin are received by an area in the cerebrum. This is interpreted on the basis of previous experience. Recognizing sensations is an activity of the brain.

Investigation

How does the cerebellum function?

Ask the children to stand erect with their eyes shut. Encourage them to tell whether they are able to maintain their balance and posture or whether they feel as if they will fall down. Help the children to realize that the brain is getting continuous information from the muscles and the joints about the positions of the limbs and is sending messages to correct any imbalance in posture. This corrective role of the brain helps them to stand. Help them to realize that this activity is carried out by the part of the brain called the cerebellum.

Demonstration

What is a reflex action?

Select a boy and ask him to stand in front of the class. Pretend to strike the boy in the face. Let the other children observe the behaviour of the boy. The boy draws back. Help the children to realize that the brain is not involved in such a response. The action takes place through the spinal cord alone. See Fig. 10-17 for an understanding of the knee reflex.

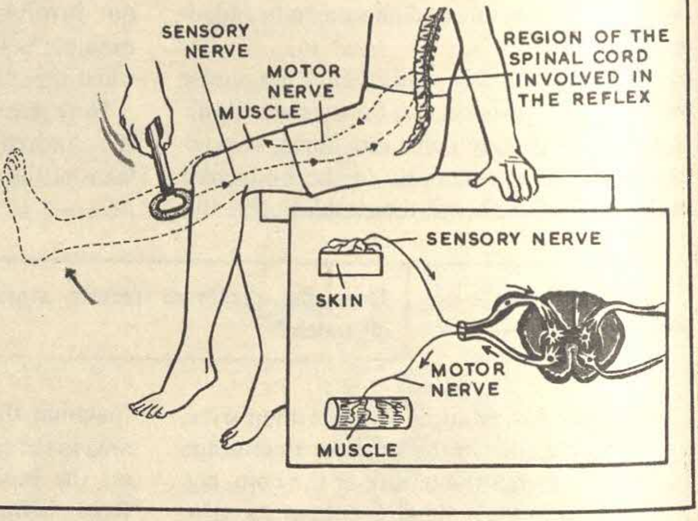


Fig. 10-17
The knee reflex.

Help the children to draw the different parts of the central nervous system.

1(b). THE PERIPHERAL NERVOUS SYSTEM CARRIES IMPULSES TO AND FROM THE CENTRAL NERVOUS SYSTEM

The peripheral nervous system consists of the nerves that are directly connected with the brain or the spinal cord. The nerves are of two types:

(i) Sensory nerves. They collect impressions from the different sense organs, like the skin, the eyes, the ears, the tongue and the nose and convey these impressions to the brain.

(ii) Motor nerves. They convey the impulses from the brain and the spinal cord to the muscles. Some carry impulses to glands and make them secrete.

Besides the sensory and motor nerves, there are swellings on the nerves containing the nucleii of the nerve cells. These are called ganglia. Ganglia act as relay stations where impulses are passed from one nerve cell to the next.

Here are some activities which can help the children to understand this idea.

Investigation **How do nerves carry messages?**

Arrange cards in pairs so that the two members of each pair stand slanting and balancing each other. The different pairs stand close together in such a way that if a card is disturbed and allowed to fall down at one end, the successive pairs would also start falling down, one after the other. Invite the children's attention to see how the disturbance set in at one end of the pack is carried over to the other end. Nerves carry sensations in a somewhat similar way. However, the nerves rearrange themselves after the passage of sensations, thus again getting ready to carry over another disturbance.

Investigation **How do sensory and motor nerves function?**

Ask a boy to stand in front of the class. Cover both his eyes with a handkerchief. Instruct another boy to tickle him on the neck. Allow the rest of the children to observe the reaction. The boy will either laugh or withdraw. Help the children to realize that the sensation of tickling reached the brain from the skin by means of sensory nerves. The message from the brain was conveyed to the muscles of the legs or the face of the boy resulting in laughter or withdrawal.

Discuss with the children how they hear a friend calling and respond to the call. When the sound of the call reached the ears, its sensation was passed on to the brain by the auditory nerve which is therefore called a sensory nerve. The message from the brain was *conveyed to the muscles of the neck by motor nerves. As a result, the boy turned his head in response.*

Ask the children to explain why a person loses his power of smell temporarily when he suffers from common cold. The sensory nerve endings which are responsible for receiving the sensations of smell, and which lie on the roof of the nasal cavity are affected by common cold.

1(c). THE AUTONOMIC NERVOUS SYSTEM HAS SPECIAL FUNCTIONS

This system governs some activities which are carried out automatically. A person is not conscious of such activities under ordinary circumstances. The nerves of this system neither convey sensations to the brain nor carry the message of the brain to the parts concerned. The working of the autonomic nervous system goes on, whether it is desired or not. This system is only indirectly connected with the central nervous system. The whole system consists of chains of ganglia. The control of the autonomic nervous system is independent of human will; hence this is also known as the *involuntary nervous system*. Here are some activities which can make the children understand the function of this system better.

Familiar Experience

How does the autonomic nervous system function?

Encourage the children to recall the experience they sometimes undergo at the time of examinations. There is pounding of the heart. They feel like going often to urinals. Guide them to realize that this is due to the stimulating action of the autonomic nervous system.

Ask the children to explain why the face turns pale in times of fear and red when someone is blushing. The fine blood vessels supplying blood to the facial skin get dilated in blushing and shrink (become constricted) in fear. This results in either excess (blushing) or deficient (fear) blood supply to the skin of the face. Such activities of the blood vessels are under the control of the autonomic nervous system.

Discuss the control of breathing. Usually this is controlled by the autonomic nervous system. when we wish, however, we can take over conscious control of breathing. Yoga experts can similarly have partial control over some functions of the body which are sub-conscious and automatic.

2. NERVES PERFORM DIFFERENT FUNCTIONS

Nerves are made up of special kinds of cells which carry impulses to and from the central nervous system. The sensory nerves carry the information to the brain from various sense organs like the eye, the ears, the nose, the throat and the skin. The motor nerves carry impulses from the brain to the muscles and also to some glands.

The sub-concepts which follow are organized in such a way as to help students understand this major concept.

2(a). SOME NERVES CARRY IMPULSES FROM THE SENSE ORGANS TO THE BRAIN

There are different sense organs in the body: the eyes, ears, nose, tongue and skin. Through the sense organs each person gets information about his surroundings. There are nerves called the sensory nerves which carry the messages from these sense organs to the brain. The nerves of sight carry messages from the eye and the nerves of hearing carry messages from the ear. Information from the nose is carried by the nerves of smell, and from the mouth by the nerves of taste. Touch, pain and temperature sensations are carried by nerves from the skin. All such information is ultimately carried to the brain for proper interpretation. Here are some activities which can help the children understand the idea better.

Investigation | **What do sensory nerves do?** | *Material required* salt or sugar

Place some sugar or salt on the tongue of the children without allowing them to see. Ask them to tell the nature of the substance. Help them to realize that they could tell the nature of the substances because the sensation of sweetness or saltiness was carried from the tongue to the brain by the taste nerves which are sensory nerves.

Investigation | **What nerves are in the skin?** | *Material required* pin

Ask a child to close his eyes. Let another student prick him gently with a pin. Ask the first student to describe the sensation. He is in a position to tell because the sensation of pain was actually carried from the skin to the brain by sensory nerves.

Make a collection of small bottles. Fill each with different substances each having a distinctive smell. Ask the children to name the substances.

Discuss why blind men have a highly developed sense of touch for recognizing objects and persons. This is because the nerves carrying the sensations of touch and the area of the brain concerned with such sensations of touch have been highly developed through extra use.

2(b). SOME NERVES CARRY MESSAGES FROM THE BRAIN TO THE MUSCLES AND GLANDS

There are some nerves which convey the messages from the brain to the muscles and glands. These are known as *motor nerves*. When a certain action is desired, the brain sends the information through the motor nerves to the appropriate muscle groups to contract. Among the glands which receive messages from the brain are the salivary glands. Suggested below are some activities which can help the children become familiar with the idea underlying this sub-concept.

Investigation **What do motor nerves do?**

Ask the children to walk. They will be able to do so with the help of the muscles of the leg. Help them to realize that the message for walking is conveyed from the brain to the leg muscles by the motor nerves.

Ask the children to state how saliva is secreted in the mouth when some food is taken.

3. SENSE ORGANS SHOULD HAVE CARE AND PROTECTION

Sense organs like the eyes or the ears are very important. In fact, the whole world of vision and hearing depends on the effective functioning of these organs. The eyes are very delicate sense organs. Strain on the eyes resulting from reading in dim or glaring light and use of fine print should be avoided in every possible way. The eyes need to be protected against bright light, blows and sharp instruments and foreign bodies like dust and dirt. The ears should also be protected from hard blows or pointed objects.

The sub-concepts which follow are selected to help students acquire the general idea of the care of the sense organs.

3(a). READING SHOULD BE DONE UNDER PROPER LIGHT CONDITIONS

The eyes are very delicate organs. Care should be taken to avoid any undue strain on the eyes. There are certain situations when the eyes are put to strain. Reading in dim light or in glaring light strains the eyes. The amount of light should therefore be sufficient. Reading of fine print also puts a strain on the eyes. Arrangement should be made so that while reading, light comes over the shoulder. If one writes with the right hand, light should come from the left, so that the writing hand does not cast a shadow on the work. Here are some activities which can help the children to understand the idea better.

Investigation — **To what extent does dim light cause eye strain?**

Ask the children to read a book with the windows and doors of the classroom open as usual. Then, shut all the doors and windows except one or two. Ask the children to read now. Let them state whether they are reading as easily and as rapidly as before.

Investigation — **How should light be arranged for reading?**

Make the classroom dark. Arrange for a table lamp or a lantern. Ask the children to do some writing while placing the table lamp first on the right side and then on the left side. Help them decide which is the better lighting condition.

Encourage the children to describe the condition of the light for reading in the home and in the class.

Take the children to visit the reading room of a good library. Encourage them to observe the condition of the light.

3(b). THE EYES SHOULD BE PROTECTED FROM VERY BRIGHT LIGHT

It is injurious for the eyes to be kept exposed to bright light all the time. The glare of the light is a strain on the eyes. The children should not sit facing a window or the bright light. Looking directly at the sun or very bright light hurts the eyes.

Here are some activities which can help the children become familiar with the idea.

Investigation

What are the results of working while facing bright light?

Arrange the seats in the class in such a way that the children are required to face the bright light of the sun. Allow them to sit in this fashion for a short period. They will soon feel very much discomfort and actual pain in the eyes.

3(c). THE EYES SHOULD BE PROTECTED FROM BLOWS AND SHARP INSTRUMENTS

The eyes are the most useful sense organs. They should be properly guarded against any injury. Blows to the eyes and sharp instruments like a pin, a needle or a knife may cause permanent blindness. Throwing stones or pointing toy guns at others and such tricks by the children may cause injuries to the eyes and should therefore be discouraged. Children should be careful in handling sharp instruments so that they may not injure the eyes. Suggested below are some activities which can make the children realize the need for protection of the eyes from blows and sharp instruments.

Discussion

Why should we protect our eyes from blows and sharp instruments?

Why are the eyes so important to us? Is there any danger to the eyes from blows? How do sharp instruments cause injury to the eyes? Do you think that the eyes need adequate protection? After the answers are received guide the children to realize the importance of protecting the eyes from blows and sharp instruments.

Ask the children to make a list of common sharp instruments in daily use against which the eyes should be protected.

3(d). THE EYES SHOULD BE PROTECTED FROM FOREIGN BODIES

Children should be taught to protect their eyes from dust and dirt which cause irritation to the eyes. The eyes should not be rubbed when such particles enter the eyes. They should wash their eyes with fresh cool water instead. Infection may also be conveyed to the eyes by dirty hands, towels and handkerchiefs. The children should learn to protect their eyes from such dirty articles. Here are some activities which can help the children become familiar with this idea.

Familiar Experience

How should we protect the eyes from dust and dirt?

Encourage the children to recall an occasion when they had some dust particles in their eyes. There was irritation, watering from the eyes and discomfort. They felt like rubbing the eyes with their fingers. In order to remove the dust particles, the eyes should be washed by their parents with cool water for some time.

Discuss with the children the need for protecting the eyes from infection by using a dirty handkerchief or dirty fingers.

3(e). THE EARS SHOULD BE PROTECTED FROM HARD BLOWS AND SOLID OBJECTS

Ears require proper protection. Children sometimes use pointed objects in order to clean their ears. This is a dangerous practice. Any pointed object like a match-stick or a hairpin or a similar hard object should never be inserted into the ears in order to remove any collected wax. The ear drums may be punctured by such a practice. This may lead to permanent deafness. The children should never be punished by boxing the ears as it may cause damage to the ear drums. Here are some activities which can help the children to become familiar with this important idea.

Discussion

Why should ears be protected from hard objects?

Engage the children in a discussion. How do the ears serve a useful purpose for us? How may hard blows cause harm to the ears? Why should we avoid using any pointed object to clean our ears? Guide the children through such questions to realize the need for protecting the ears from hard blows or pointed objects. Encourage them to clean their ears with a soft cloth and warm, soapy water.

Explain to the children with the help of a diagram of an ear how a sharp instrument may damage the ear drum. See Fig. 10-18.

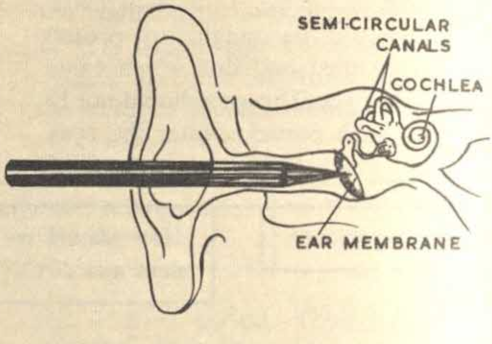


Fig. 10-18
How a sharp instrument (e.g., a pencil) can damage the ear drum.

4. DIFFERENT BONES IN THE BODY HAVE DIFFERENT FUNCTIONS

When one builds a house, he requires some kind of a framework. So is the case with the human body. The framework is the bony skeleton. Many bones, large and small, combine to form the human skeleton. There are 206 bones in the skeleton. Some of the main bones are the skull, the backbone, the breastbone, the ribs and the bones of the limbs. The skeleton with a clothing of muscle on it gives real shape to the human body. The bones afford protection to various delicate organs of the body like the brain, the spinal cord, the heart, the lungs, the stomach, and the intestines. The bones combine to form various types of joints in different parts of the body. The joints allow movements of different kinds, depending on our need. The following sub-concepts are intended to help students to acquire a broad, general understanding of the bones of their bodies.

4(a). CERTAIN LARGE BONES ARE AMONG THE MAIN BONES OF THE BODY

The human skeleton is composed of a number of bones of different sizes. There are however some bones in the body which may be called the main bones. They are as follows.

The Skull. The bones of the skull are thin and flattened. They are light and joined together by saw-like edges. All the bones together make a dome shape; the joints are immovable. The bones form a cavity which protects the delicate brain from any external injury. The skull has two sockets for the eyes and holes for the ears, and the nose. The lower jaw is hinged to the bottom of the skull.

The Backbone. The backbone or the spine is made up of a number of small bones called *vertebrae*. They are separated from each other by cushions. Limited movement is allowed like the bending of the body forward and sideways. The canal formed with the vertebrae houses the spinal cord. There are thirty-three vertebrae in the backbone. They become twenty-four in adult life as the lower nine bones are fused to form two separate bones called the sacrum and the cocyx.

The Breastbone. The breastbone or the sternum is situated in the front and is joined to the spine by means of the ribs. The bone is wider at the top and gradually diminishes downwards.

The Ribs. There are twelve pairs of ribs altogether. The ribs are thin bones which come out of the vertebrae. The upper seven pairs of ribs are directly joined with the breastbone. The next three pairs of ribs are connected with the breastbone by means of cartilages. The lowest two pairs of ribs do not join up and are called floating ribs. All the ribs have slightly flexible joints at their ends. This permits the chest cavity to expand or contract and thus makes the breathing possible.

The Bones of the Limbs. These are bones of the two arms and the two legs. The bones of the arms and legs are very similar. There is one bone in the upper arm. The lower arm consists of two bones. The wrist and hand together have twenty-seven small bones, eight in the wrist, five in the hand and fourteen in the fingers. Similarly in the legs, the number of bones that go to form different parts are: one in the thigh bone, two in the shin bones, seven in the ankle, five in the foot and fourteen in the toes.

Besides the above, there is a flat triangular shaped shoulder-blade and a collar-bone near the shoulder joint on each side. At the lower part of the trunk there are two strong and massive bones which curve towards the back of the body, called the hip-bones. The following activities will help the children to understand about these bones.

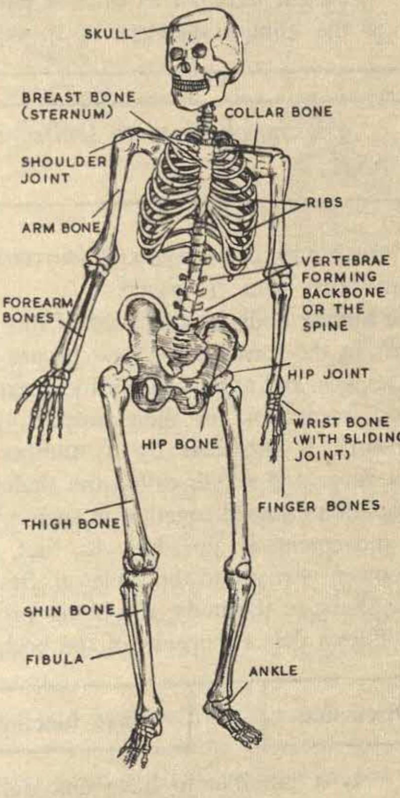


Fig. 10-19. The human skeleton.

Investigation **Are there different kinds of bones in the body?**

Select a thin boy and instruct him to take off his shirt. Ask some children to count the ribs of the boy. Encourage them to feel the ribs through the skin and muscles with their fingers. They will find that there are 12 pairs of ribs present. Some other children may be asked to feel the main bones of the body. See Fig. 10-19 above.

Demonstration

What does a human skeleton look like?

Material required
simple figure
of a human
skeleton

Ask the children to draw a picture of the human skeleton as shown in the accompanying figure. Instruct them to label the various bones.

Ask the children to feel and name the various main bones of the body.

4(b). THE BONES GIVE SHAPE AND PROTECTION TO THE BODY AND ITS PARTS

The human body is composed of millions of cells in the forms of various tissues like muscles, skin and organs. All of them require a basic framework for their support. This framework is provided by a number of bones, large and small, called the skeleton. The bones are joined together in such a way that movement is possible. In fact, the body owes its shape to the skeleton. Besides giving shape to the body, the bones protect the different delicate organs of the body by forming several cavities. The skull and the backbone canal protect the brain and spinal cord. The chest cavity, formed by the breastbone, the spine and the ribs, gives protection to several vital organs like the heart and the lungs. The pelvic cavity, formed at the lower part of the abdomen by the pelvic bones, the sacrum and the coccyx, protects the urinary bladder, the lower part of the intestines and the female uterus. Here are some activities which can help the children to understand the idea better.

Discussion

What functions do our bones serve?

Is it possible to have any definite shape for the body without the bones? How do bones give shape to the body? Do bones serve any other useful function? Help students give some example wherein bones provide protection to delicate organs. Lead the children through such questions to appreciate the important functions that the bones serve in the human body.

Familiar Experience

How does the skull bone protect the brain?

Encourage the children to recall an occasion when their heads struck against a hard object and the brain was saved from any injury due to the strong skull bone protecting it.

Help the children to name the important organs that are protected by the bones forming the chest cavity.

4(c). MOVEMENT IS PERMITTED BY THE JOINTS OF BONES

Whenever a bone meets another, a joint is formed. There are several types of joints in the body. Some are movable and some are immovable. An immovable joint is found in the bones of the skull. Here the bones are joined in such a way that no movement is possible. The movable joints of the body are of different types. See Fig. 10-20. They can be classified in the following way.

Ball-and-socket joint. The joint is formed when the rounded end of a bone fits into a cup-like cavity of another bone. This kind of joint allows a wide range of movements. The shoulder and hip joints are examples of this kind of joint.

Hinge joint. Movement of this type of a joint is restricted only to the forward and backward direction. This is similar to a door moving on a hinge. The knee joint, elbow joint and finger joints are examples of this type.

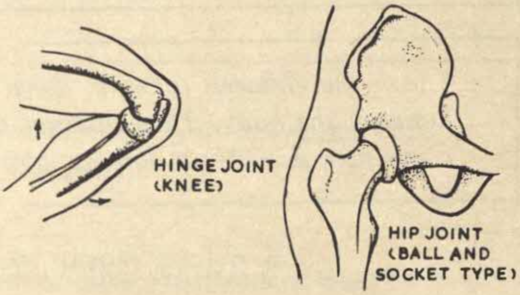


Fig. 10-20. Some movable joints of the body.

Sliding joint. In this joint, one bone slides over another. The wrist joint is an example of this.

Pivot joint. Here one bone acts as a pivot around which the other rotates. The movement of the head is an illustration of this kind of a joint. There is also such a joint in the forearm near the wrist. This joint is used in turning a screwdriver or a key, or in wringing out clothes.

Here are some activities which can help the children to become familiar with the different types of joints in their bodies.

Investigation | **What types of joints are in our thumbs?**

Ask the children to move the joints in the thumb. Encourage them to tell which joints in the thumb are hinge type and which ball-and-socket.

The joint at the base of the thumb is a ball-and-socket type and the joint nearer the end of the thumb is a hinge type.

Investigation | **What are some different types of bone joints?**

Ask the children to place the hands upwards on the desk and then raise the forearm towards the upper arm. Then ask the children to rotate the hand so that the palm faces down. Encourage them to tell the types of joints that are brought into play in these two movements. The former is an example of a hinge joint and the latter, of a pivot joint.

Ask the children to write down the names of different types of joints in the body. Then instruct them to write down the name of a machine in which a similar joint is used.

5. MUSCLES PROVIDE MANY KINDS OF MOVEMENTS

Muscles are responsible for all the body's movements. Muscles are attached by tendons to different bones. When they contract, they draw nearer the parts of the body to which the muscle tissue are attached. Various muscles of the body are busy in moving joints. The movement of the arm or leg is under the control of the will. The muscles causing such movements are called voluntary muscles. The muscles of the heart and intestines are involuntary as they move continuously irrespective of our desire. Each person should try to develop his muscles. This is possible by taking regular physical exercise or maintaining a correct posture.

5(a). ALL MOVEMENTS OF THE BODY ARE THE RESULTS OF MUSCULAR CONTRACTION

Muscles have the power of contraction. When they contract, the muscles become shorter and thicker. Generally, muscles are attached to bones by means of tough fibrous cord-like structures called tendons. For example, one muscle is attached to the upper armbone, crosses over the elbow joint and is attached to the lower arm. It pulls the lower bone towards the upper arm when it contracts. Sometimes contraction of a group of muscles is responsible for the desired movement. Thus all movements of the body are the results of muscular contraction. While a muscle or a group of muscles contracts, another muscle or a group of muscles relax. Suggested below are some activities which can help the children to understand the idea better.

Investigation **What action of the muscles makes the forearm move?**

Ask the children to bend the arm at the elbow joint and feel the muscle of the upper arm (biceps) with the other hand. A thickening of the muscle will be felt. Then ask them to straighten the forearm. The thickening of the opposite muscle at the back of the upper arm (triceps) will be felt.

Investigation **Do muscles contract to move the leg?**

Ask the children to sit on the chairs. Instruct them to straighten their legs. Let them feel the muscles of the thigh above the knee. The muscles thicken and contract.

Discuss with the children how the contraction of the muscles is responsible for the movements of the body.

Ask the children to draw a diagram to show the action of muscles causing movements of a part of the body.

Discuss the muscular movement of some non-bony parts of the body, like swallowing, closing the eyelids, or twisting the tongue.

5(b). MOVEMENTS OF SOME MUSCLES ARE VOLUNTARY; OF OTHERS INVOLUNTARY

There are some muscles in the body which can contract or relax when one desires. Movements of such muscles are under control. These muscles are known as the voluntary muscles. Examples of voluntary muscles are the muscles of the limbs, neck, face, etc. These muscles act through the central nervous system. They get fatigued with continuous work.

There are other muscles in the body which are termed involuntary muscles. They form the walls of the stomach, intestines, heart, blood vessels and other internal organs. They are not controlled by will power. They are at work from the beginning of life and are not fatigued by working continuously. They work under the control of the autonomic nervous system. The children will be able to understand the idea better if they are invited to do the following activities.

Investigation **How do voluntary and involuntary muscles differ?**

Ask the children to move their limbs, or head, or to open and close their eyes or mouth. They will be able to do so as the muscles causing these movements are under their control. Now ask the children to stop the activity of their hearts and then check if they can do it by feeling the pulse. Obviously they cannot do it as the action of the heart muscles is not under their control.

Discuss with the children the movements of the voluntary and involuntary muscles of the body.

Ask the children to give some examples of voluntary and involuntary muscles. Muscles of the arm and leg are voluntary while those of the heart, stomach and intestines are involuntary.

5(c). PHYSICAL EXERCISE AND RIGHT POSTURE ARE ESSENTIAL FOR NORMAL DEVELOPMENT OF MUSCLES

Muscles grow by producing new fibres. This is only possible by improving the nutrition of the muscle tissues. Physical exercise increases the force and frequency of the heart and improves the circulation of blood through the muscles in the body. Muscles are thus supplied with more food which is derived from the blood. The blood stream also carries away the waste products formed in the muscles after each movement. Physical exercise is therefore essential for normal development of muscles.

Beside physical exercise, posture is another important factor which contributes to the development of muscles. Correct posture economizes the muscle energy. Some muscles become weak and get stretched, and tire easily if an incorrect posture is assumed. Return of blood through the veins is also impeded as the incorrect posture interferes with the functioning of the diaphragm. The activities suggested below can help the children become familiar with the idea.

Field Visit

How does physical exercise affect the development of muscles?

Take the children to a gymnasium. Encourage them to observe the development of muscles of the body of the participants. Guide the children to realize that this has been possible due to physical exercise.

Class Project

Does physical exercise improve the development of muscles?

Encourage some boys to take regular physical exercise. Let the children observe the development of muscles after six months. Let them compare these with the muscles of those who have not taken any exercise.

Ask the children to explain why persons in the army as a whole have well developed muscles.

6. COMMUNICABLE DISEASES ARE TRANSFERRED IN MANY WAYS

Communicable diseases can be transmitted from one person to another directly or indirectly. The germs of diseases live and multiply in a sick person. The germs can be transmitted to another individual who may then develop the disease. Germs may be conveyed from one person to another in the following ways:

a. By articles of food and drink infected with the germs which produce the disease.
b. By breathing droplets or dust particles infected with the germs of the disease.
c. By inoculation from insects: germs of some diseases are carried by insects which bite the human beings. During the bite, germs are introduced into the human body.
d. By contact—some diseases are conveyed directly by personal contact or indirectly by sharing common towels, clothes, handkerchiefs, combs, etc.

These four means of disease transmission are the basis for the sub-concepts which follow.

6(a). SOME DISEASES ARE SPREAD BY WATER AND FOOD

Diseases may be transmitted from a sick to a healthy individual through food or drink contaminated with harmful organisms. Examples of such diseases which spread by water and drink are cholera, typhoid fever, and dysentery. Germs of the diseases are found in excreta of an infected person. Drinking water may be contaminated at the source by such excreta. Germs may be carried to food or drink from the hands of persons handling them if they do not wash their hands properly after going to the latrine. House-flies, cockroaches and other insects may contaminate the food if they come in contact with it after sitting on the excreta of an infected individual. Here are some activities which can make the children understand this idea better.

Discussion

How do diseases like cholera, typhoid, and dysentery spread?

Engage the children in a discussion regarding the diseases which are spread by food and water. Where do the germs come from? How does the water or food get contaminated? How can we avoid getting such a disease? Encourage the children to realize through these questions the important idea underlying the concept.

Take the children to the kitchen of a nearby boarding school.

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Encourage them to observe how articles of food and drink are kept free from contamination.

6(b). SOME DISEASES ARE SPREAD THROUGH THE AIR

Germs of some diseases are found in the breath of persons suffering from those diseases. The germs come out from the nose, mouth, throat or lungs along with minute droplets of fluid. Droplets containing the germs are given out when the infected person coughs, sneezes or even talks to an individual. A healthy person is likely to suffer from the disease if he breathes such droplets. Later on some droplets may fall on the ground. The germs may get mixed with dust and may be carried to a long distance by air. A healthy person may catch the disease if he inhales the dust particles containing the germs. The diseases which spread by such means are known as *air-borne diseases*. Examples of air-borne diseases are common cold, influenza, pneumonia, tuberculosis, mumps, measles, scarlet fever, chicken-pox, smallpox and diphtheria. Suggested below are some activities which can make the children become familiar with the idea.

Familiar Experience

How can diseases spread through air?

Encourage the children to recall the outbreak of common cold or influenza in the homes in the vicinity. When some one in the family suffers from the disease, most of the other members also become victims of the disease in a few days' time. Guide the children to realize that the disease gets a chance to spread to others by air when the first victim coughs or spits.

Discuss how one can avoid getting an air-borne disease.

6(c). SOME DISEASES ARE CARRIED BY BITING INSECTS

Insects are intimately related to man. Some of the biting insects carry the germs of different diseases. They transmit the diseases to man. The mouths of such insects are lengthened into needles which lie in front of the head. The insects usually like to feed on animal blood. When the insect bites an infected person, it sucks the blood along with the germs into its stomach and become infective. When this insect now bites a healthy person, the germs are introduced in the blood of such a person. The germs develop and produce the disease. Some common biting insects are the mosquitoes, the rat flea and the bee. The mosquito (only the female) transmits diseases like malaria, filaria, yellow fever, and plague. The flea is an insect which lives on the body of a rat. It carries the germs of bubonic plague. Lice carry the germs of typhus. Suggested below are some activities which can help the children become familiar with the idea.

Discussion

How do biting insects transmit diseases?

Which diseases are carried by biting insects? How do the insects become infective? How do they transmit the germs of the disease to man? Encourage the children to realize through such questions that some diseases like malaria, filaria, plague and typhus are carried by some biting insects.

Ask the children to explain why mosquito nets are used at night in some areas.

If dying or dead rats are found in the vicinity of a seaport, the medical officer examines the carcasses. Why does the officer examine dead rats? What does he suspect? The medical officer suspects that the plague has broken out among the rats. He examines dead rats to confirm if the rats have died of plague. The plague germs are carried by rat fleas, parasites living on the bodies of rats. When the rats die, the fleas leave their bodies in search of food. Their food is animal blood. Human beings are likely to be attacked by fleas. The plague germs are transmitted to the blood of such persons by the bite of infected fleas. The plague transmitted in this way is known as bubonic plague.

6(d). SOME DISEASES ARE SPREAD BY DIRECT CONTACT

There are some diseases which spread from an infected person to a healthy one by direct contact. The germs of such diseases invade the skin of the person. A person can pass on the germs at a very early stage of the disease before it can be easily recognized. Contact diseases often spread rapidly in overcrowded places. Ring and scabies spread from person to person directly or through sharing clothing and bed-clothes which have been used by the sick person. The germs of chicken-pox and smallpox pass from a sick to a healthy individual through contact, through droplets or through using clothes, or bed linen, or utensils used by the sick person. Trachoma is a disease of the eye which can easily occur in overcrowded places. Infants often get it from their mothers, brothers or sisters or any other attendant. Scarlet fever can be caught by contact with the scales of the skin of those who are in the process of recovery from the disease. Here are some activities which can help the children become familiar with this important method of the spreading of disease.

Familiar Experience **How does scabies spread?**

Ask the children to recall an occasion when they got scabies. They might have noticed that some of their other younger brothers and sisters also contracted this. The disease also spread rather quickly to other parts of the body. Ultimately the disease was controlled after prompt and adequate treatment, and good personal hygiene, regular use of clean towels, bed sheets etc. Encourage the children to realize that the germs of scabies spread by contact.

Discuss with the children why contact diseases are common where there is overcrowding and dirt.

7. PRECAUTIONS HELP IN PREVENTING THE SPREAD OF COMMUNICABLE DISEASES

The spread of communicable diseases can be greatly reduced or prevented entirely by precautions. Precautions can be of these three types:

a) By checking the spread of infection from infected persons by healthy ones.
b) By checking the growth and multiplication of germs.
c) By increasing the disease-resistance of the human body.

7(a). SOME PRECAUTIONS FOR CHECKING THE SPREAD OF GERMS FROM ONE PERSON TO ANOTHER

Everything should be done to prevent contamination of food and drinking water. Food should be kept in such a way that it is protected from dust and flies. Boiling milk before drinking ensures safety as it kills the harmful germs. The sources from which drinking water is obtained should be protected against impurities. Homes and surroundings should be kept clean. This will prevent the breeding of flies and mosquitoes which carry the germs from an infected person to a healthy one.

Flies may carry disease germs from human excreta to articles of food and drink. Proper disposal of human excreta is therefore essential. Hands should be properly washed before taking food. This deserves special attention after use of toilet or any contact with a sick person. In case of some infectious disease, the patient should be isolated in a separate room, preferably in an infectious diseases hospital. This will help in checking the spread of the disease. Here are some activities which can make the children realize the importance of taking the preventive measures as described above.

Investigation

How can we prevent the spread of microbes?

Materials required
molasses
pot

Take a small quantity of molasses in a pot and keep it in the class. Soon you will see a number of flies collecting over it. Ask the children to find out from where the flies are coming. Encourage them to look for places like cow dung heaps, garbage cans, or a latrine. Help them to realize that flies from such places carry disease germs and contaminate our food. Ask the children to state the precautions that should be taken to prevent transmission of germs in such a way.

Ask the children to explain why hands should be washed before eating and particularly after toilet or any contact with a patient.

Organize a periodical sanitation drive in the school.

7(b). SOME PRECAUTIONS ARE NEEDED TO CHECK THE GROWTH AND MULTIPLICATION OF GERMS

Germs or microbes grow and multiply in decaying organic matter. Garbage should not be allowed to accumulate and decompose near the houses. It should be hygienically disposed off by constructing a compost pit. Homes and surroundings should be kept neat and tidy. To leave excreta exposed in places behind the house is very dangerous. The best way to get rid of excreta is to use a latrine. Destruction of the disease-producing germs is an important step to check the spread of disease. This is called disinfection. Beddings, clothings used by the patient should be exposed to the sun for several hours. Utensils of the patient should be heated in boiling water. Discharge of the patient like stool, vomit, sputum, etc., should be disinfected with quicklime before disposal. All latrines and private drains should be sprinkled with lime or bleaching powder daily. Water for drinking should be treated with bleaching powder or potassium permanganate if it is suspected to be impure. It is always safe to boil the water before consumption. Suggested below are some activities which can help the children to understand the idea better.

Discussion

How can we check the growth and multiplication of microbes?

Where do microbes grow and multiply easily? Why is disinfection of articles used for the discharges of the patient necessary? How can you disinfect them? What will you do if water suspected to be impure is to be used for drinking? Encourage the children through such questions to realize that precautions like disinfection and proper disposal of refuse or excreta are necessary to check the growth and multiplication of microbes.

With the assistance of the health authorities arrange for occasional spraying of a disinfectant on the walls, floors, ceiling and furniture of the classroom.

Discuss why the public is advised to boil drinking water by the municipality at times when there is the threat of an epidemic.

7(c). SOME MEASURES LIKE VACCINATION AND INOCULATION IMPROVE THE RESISTANCE OF PERSONS TOWARDS DISEASE

Some of the communicable diseases can be checked by vaccination and inoculation. The resistance of the body against the the disease is increased by introducing some substance in the human body by artificial methods. Vaccines are available for smallpox, cholera, typhoid, diphtheria, tetanus, whooping cough, poliomyelitis and tuberculosis. Some of the vaccines are highly effective. Vaccination, for example, is the surest method of preventing smallpox. The resistance developed by these methods varies from disease to disease and lasts from several months to several years. Here are some activities which can make the children become familiar with this important method of the prevention of disease.

Discussion **How do we prevent smallpox?**

Discuss with the children how smallpox can be checked by proper vaccination. Vaccination increases the resistance of the body against smallpox. Discuss the anti-smallpox campaigns in our country.

Ask the children to name the diseases for which they have had an inoculation.

Arrange for an inoculation programme against cholera or typhoid in the school in co-operation with the health department of the locality.

In addition, the body's general resistance against all diseases should be maintained at a high level. Healthful living, including a generous well-balanced diet and adequate rest and exercise, does much to keep an individual from contracting some diseases.

Scientists at Work

Three European scientists had key roles in controlling communicable diseases

Here is a story of how man has learned to control infectious diseases through the application of the scientific method. It is a story with three characters: Edward Jenner, Louis Pasteur and Joseph Lister.

Most of you can recall when you were last vaccinated against smallpox. Vaccination is slightly painful. Yet it effectively prevents the vaccinated person from getting the disease. The discovery of vaccination marks the beginning of preventive medicine. It is highly interesting to know how vaccination was discovered.

You know scientific progress rests on careful observations and their interpretation (hypothesis-making). The hypothesis, of course, is to be tested and confirmed, or revised and tested again through experimentation. Edward Jenner, a British physician, had the qualities of a scientist. He was a careful observer, an intelligent interpreter and an energetic experimenter. With these qualities, it is no wonder that he discovered vaccination as a first step in preventive medicine.

Before Jenner discovered vaccination, it was known that a mild disease called cowpox sometimes affects the nipples of cows. The symptoms of cowpox are very similar to smallpox. Often the milkmaid milking such a diseased cow was also found to contract this disease, first at the fingers and from there to other parts of the body. It was also known that horses also sometimes suffer from a disease (called grease) similar to smallpox.

The above facts were known even before Jenner. It was also probably known that a person having once suffered from cowpox was afterwards secure from the infection of smallpox. Jenner was the first to see the full significance of this observation. He, however, first thought it better to confirm the observation by controlled experiments. Having demonstrated that "the cowpox protects the human constitution from the infection of the smallpox", he proceeded to use this observation for the benefit of mankind. He prepared a vaccine that was effective in preventing the incidence of smallpox.

Jenner made use of observations about the occurrence of cowpox and smallpox for devising a method of preventing diseases. But the question of the cause of the disease remained to be answered. At first sight it seems no good to know the cause of the disease. But the story of Pasteur shows that such theoretical questions as 'what is the cause of an event' do often help in the solution of practical problems (like prevention of a disease).

Louis Pasteur was born in France in 1822. Many problems that Pasteur tackled during his scientific career were industrial in origin. For example, the wine-makers approached him with the problem that their wine turned into vinegar in an almost uncontrollable way. He showed them how to keep wine from spoiling by heating to 55° C. This process of improving the keeping quality of liquids (wine, milk, etc.) by destroying most of the micro-organisms by heating is called pasteurization. Milk is now pasteurized by heating it for either 30 minutes at about 62° C or 15 seconds at 72° C. This is followed by a sudden chilling to a low temperature. The process of 'pasteurization', applied to milk has been of very great importance in reducing the death rate of infants. While working on a very practical problem facing the silk industry, Pasteur discovered and developed a very useful guess which underlies the modern germ theory of disease. This guess was about the cause of certain diseases. Pasteur thought that specific bacteria caused particular diseases. Applying this idea he could save sheep dying of anthrax, and chickens from cholera.

Joseph Lister was the founder of antiseptic surgery. While working as a Professor of Surgery in Glasgow (England) he became deeply interested in the problem of pus-formation in wounds. At that time the mortality rate of wounded persons was very high. He worked upon these two ideas given by Pasteur: (i) every disease has its specific germs, and (ii) new germs are produced only from previously existing ones of the same kind. He thought that pus is formed by some kind of germs. Therefore, he argued, pus-formation can be checked by killing germs that contaminate wounds and then bandaging so that no new germs enter the wound from outside. He used carbolic acid (a chemical capable of killing bacteria) as an antiseptic for washing the wounds and preparing the bandage. The results were far better than expected. Antiseptic treatment was soon generally adopted by surgeons.

Jenner, Pasteur and Lister were all true scientists. They were seeking explanations of the things which they observed. In so doing, they not only satisfied their own scientific curiosity —they also did invaluable service to mankind.

UNIT 11

SAFETY AND FIRST AID

CLASS I

Overview

The organization of learning in Unit 11 is somewhat different from that of other units in this syllabus. Although the practice of safety and first aid involves principles of science, these very young children are not yet capable of understanding most of them. It is essential, however, that even these children learn the attitudes and behaviour patterns which make for health and safety.

In this unit, for the first three classes, desirable habits are classified into seven divisions as follows:

1. Walking and running
2. Cycling
3. Riding in a bus, rickshaw, or tonga
4. Playing games and being with animals
5. Working with tools, stoves, lamps, and so forth
6. Bathing
7. Using electrical equipment.

For each of these seven divisions, a set of suggested behaviour patterns has been provided. These are not exhaustive lists; they can often be improved to meet local situations. Furthermore, they are not 'rules to be memorized'. Rather they are patterns of behaviour which children should be taught to follow. This can be done best if children really *want* to follow them. These ideas will be learnt better, remembered longer, and used more effectively when children carry on first-hand observations of these behaviour patterns. The suggestions for teaching which are provided for each set of behaviour patterns are intended to encourage this kind of learning.

1. WALKING AND RUNNING

Learning starts very early in life. Every child has to learn to sit, to stand, and to walk. He learns these skills in the safe surroundings of his home. While learning these skills he may also suffer injuries, but they are not serious because of the adult care available to him. As he grows older he may even go for a walk outside the house but this is again under the supervision of an adult.

In class I, while going to and from school, children may have their first chance to go alone outside the house. However, the care and supervision of an adult may not be available to them on their walks between the school and home. It is, therefore, necessary to prepare them for this independent activity. Children are accustomed to supervision at home and school. But, between the school and home, they must learn to walk and run safely without supervision.

Here are some patterns of behaviour for safe walking that children may learn at this stage:

a) Walk only on the foot-path. If there is no foot-path, then walk on the right side of the road.
b) Always look ahead while walking.
c) Walk in single or double file.
d) Go straight home from school.
e) Walk safely; playing, pushing and shoving may result in injury.
f) Keep away from busy roads at night.

The teacher's problem is how to develop safety habits in children. If these directions are given as formal pieces of instruction to be memorized, they may not have the desired effect. Through a discussion children should be guided to acquire the habit patterns of walking safely by themselves given above. Rules of behaviour of their own making are more acceptable than those imposed by some adult authority.

Here is a suggestion for discussion. Start by asking: 'What are the functions of a road and a foot-path?' 'Why is a foot-path made by the side of a road?' This will lead to the formulation of the first part of rule 'a' above. The example of a child stumbling because he was not looking ahead may be discussed in connection with item 'b' above. Similarly 'c', 'e' and 'f' may be discussed as precautions for avoiding situations which might lead to accidents. The second part of rule 'a' may be taken up as a part of the information about vehicles keeping to the left in our country. When one walks on the *right* side, he faces the oncoming traffic, and is safer, because he can see it. Children may be encouraged to discuss the necessity of 'd' parents generally worry if the children are very late.

No purpose is served by rote-memorization of the above rules. The children should be so conditioned from the beginning that they follow the above and other similar safety rules almost spontaneously. Children from the same part of the village may be asked to supervise one another's safety habits on the road. Inspection of a scene of accident or an interview with one who has suffered for not observing the rules of safety will be found very helpful in making the children safety-minded while walking.

Setting a good example is an excellent way of developing good safety habits in young children. As they often imitate adults and older children it is important that teachers and older students do their part by setting good examples for the little ones.

2. CYCLING

Children at the class I level are seldom able to ride cycles themselves. Their experience of cycles consists of being taken for rides by older people, and an admiration for other people's cycling equipment. Many of the boys in class I may wish to ride, and they should be encouraged to look forward to the time when they can begin to ride cycles safely. For the present however, they should be helped to do safely those things which they can do.

Some small boys have developed a technique of riding a full-sized cycle by putting one leg under the bar. This is not a safe way to ride. Children should be discouraged from riding in this way except in places where there are no traffic hazards.

Some of the desirable behaviour patterns related to class I children and cycling are:

a) When riding a cycle with an adult, hold on firmly; use both hands.

b) When riding with an adult, keep your feet away from the wheels.

c) When riding with an adult, do not move around, but sit quietly. Don't bother the adult with unnecessary questions and talk.

d) Do not disturb cycles which are parked; these are other people's property and you should respect them.

e) Do not play with a standing cycle; it may fall and injure you or be damaged.

It is not very effective simply to teach patterns of good behaviour such as those above by words alone. Children will be much more interested in these rules of behaviour if they have a first-hand contact with cycles and cycling. For example, a cycle may be brought to school and some children can demonstrate the proper way to be taken for a ride. If there are some children who have never been for a ride on a cycle, the teacher should arrange to give them this experience.

One of the things any child can do to make his life safer is to learn to follow directions. This kind of thing can be taught as early as in class I. For example, the teacher may instruct the class as a whole to move a certain cycle from one place to another. Then he can select one student and challenge him to follow those instructions exactly while the other children watch. In doing this, children should be urged to ask questions if they do not understand the directions perfectly.

Although class I children are too young to be personally effective when accident occur, they can help by reporting injuries or dangerous practices to the proper persons. Children should be urged always to report even small cuts and bruises to their teacher or their parents. Children should be praised when they report dangerous situations to adults.

Little children envy older children and adults. The little ones can hardly wait until they are old enough and big enough to do some of the exciting things they see other people doing. This envious desire often produces an admiration for older children and for adults. For this reason children often imitate their elders. Accordingly, it is a good idea to provide excellent examples of behaviour patterns for young children. Teachers should set an example and also urge older children to provide good examples of cycle safety for class I children to observe and imitate.

Children at the class I level love to play and make-believe. Some teachers have been successful in having children 'ride an imaginary cycle'. In so doing, the children can learn about where to ride, how to signal properly, and how to respect the rights of others.

3. RIDING IN A BUS, RICKSHAW, OR TONGA

Just to see a moving vehicle provides great excitement to children in class I. In rural areas they like to rush out of schools to see a bus or a car as soon as they hear the sound of the engine. They delight in looking at these wonderful devices. For many children, the height of their ambition is to have a ride in a motor vehicle.

Most of the schools in our country have approach roads. These enable inexpensive, modern conveyances like rickshaws, buses, and other vehicles to reach right up to the school. Some children in the urban areas are sent to and from school in buses or rickshaws or even in taxis. These easy conveyances are a splendid asset to the school and the community. They not only provide children and others with quick, modern transportation but also give them a chance to become acquainted with modern India. On the other hand, roads and motor vehicles are a safety hazard for children. The children should be taught the dangers which come along with the fun and convenience of riding in a bus. The teaching of safety in motor vehicles is thus an important part of learning at the class I level.

Here are some desirable patterns of behaviour which concern very young children riding in motor vehicles:

a) Once you are in a bus or rickshaw, remain seated in one place; do not move around.
b) Keep hands and arms inside the vehicle.
c) Be extremely careful when entering or leaving a bus or rickshaw before it has stopped completely; make sure the driver knows you are getting on or off.
d) Sit away from open doors; do not play with door handles.
e) Do not disturb the driver with questions and talk; be reasonably quiet.
f) While you are waiting for a bus or rickshaw, remain well off the road.

It is the task of the teacher to help the children to understand the reasoning behind these rules. For example, the children may be told how conversation and extra noise disturbs the driver so that he cannot concentrate on his job ('e' above). Again, children may be told stories about accidents that have happened to those who have kept their hands and arms out of the window, or how careless riders have fallen from a bus or rickshaw ('b' and 'd' above). Such incidents are often reported in the newspapers.

There are useful demonstrations which can help the children to see the reason for caution when riding in buses and rickshaws. For example, a small doll may be made to stand on a toy-cart; when the cart is moved suddenly the doll falls. From this the children can see why it is important to be seated in a moving vehicle ('a' above).

It is useful for the children to be familiar with motor vehicles. It is very effective to have the driver of a bus or rickshaw show his vehicle to the small children. In this way they come to like drivers and will listen to the advice and the rules that the driver may give. If buses or rickshaws come to the school regularly, a teacher should be on hand to supervise the boarding and getting down of the children. This will give him the opportunity to praise good safety habits and to draw the children's attention to certain dangerous habits.

4. PLAYING GAMES AND BEING WITH ANIMALS

Playing is a normal activity for all children. It is pretty certain that a child who does not play is suffering from some mental or physical disease. Play not only provides children with recreation, fun and exercise, but also makes them more conversant with their environment and, in a sense, prepares them for their future life.

There is a great deal of variety in playing. Some differences have a regional basis; for example, playing in water (swimming, etc.) is possible only where there is a pond, or a stream or river flowing nearby. Sometimes the differences are based on age-group interests. Moreover, the games of the boys sometimes differ from those of girls. With so much variety it is not possible to frame a general set of 'safety rules during play'. Only broad suggestions can be made. The teacher can adapt and make them more specific according to the needs of his/her class or region.

Some suggestions are:

a) Play in open spaces and not on roads; the traffic on roads may cause accidents.
b) Play away from areas where houses are being built or pulled down.
c) Play away from ditches and drains, either dry or filled with water.
d) Do not play on fences; they are made for protection and not for play.
e) Do not play on the roof of the house.
f) Be very careful when playing on wet, slippery ground.
g) After playing with toys, collect them and put them in their proper place.
h) Play only with those animals with which you are familiar and which you know will not harm you.

Children in class I are very young, and have little experience of the environment outside their own home. They may not be aware of the dangers of playing on the road, on the roof (without a suitable fencing) or near ditches and drains. In short, the children are too young and inexperienced to be able to see the risks in playing under such conditions. On the other hand, they love games so much that they start playing at the very first opportunity. By narrating stories and incidents, and through discussion, the teacher can help the children to develop good play habits.

The children may be invited to visit a house being demolished. They may be encouraged to argue why it is not safe to play near such places ('b' above).

Similarly the occasion when a boy or a girl slips on a wet surface may be made the start of a discussion on 'Why should we not play on wet surfaces?" ('f' above).

Children love to play with animals. They may not, however, have sufficient experience to distinguish between harmful and docile animals. It will help them in their behaviour towards animals if they are told about the habits of the common animals found in their surroundings. A new animal should not be approached for play unless it is known to be harmless. In general, children should keep away from animals, except pet dogs and the like. Besides, the danger of catching disease from dirty animals should also be pointed out to children. ('h' above).

As in other spheres of children's activity, there may be accidents during play in spite of the best precautions. The children may be invited to discuss what they would do if they are the victim of an accident, or if they see someone injured in an accident. Help the children to understand how essential it is to report injuries immediately to adults. Since the children are very young, they cannot do much else in case of accidents.

5. WORKING WITH TOOLS, STOVES, LAMPS, AND SO FORTH

Children are very curious to learn about the materials around them. They always like to handle things by themselves, even if these are strange things. The day a child enters school, he watches other students of higher classes using tools such as knives, scissors, sharpeners, and so forth for mending pencils and preparing charts. The child imitates his elders and tries to sharpen his own pencil. In doing so he may cut himself seriously. He also likes to handle other dangerous materials and tools such as matches, stoves, lamps, and hammers. Many of these situations can be of great danger; some could be fatal. It is important that the children know about the dangers involved in handling such tools and that they develop safe habits of using them.

In class I, the children can be helped to acquire good behaviour in handling common tools. Sometimes this means 'hands off' until or unless the children are given specific instructions and precautions for using them. In due course of time, this code of behaviour can become the basis for desirable habits. The following are some suggestions on which behaviour patterns among pupils may be developed.

a) Sharp knives and scissors are not for play; use them carefully and only under adult supervision.
b) Be very careful around stoves. They may be hot and may cause severe burns.
c) Do not play with lamps; they may be hot and may cause fires.
d) Do not throw anything into a fire unless a grown-up says it is safe to do so.
e) Never play with matches.

Teaching about these things should not be entirely a verbal process. It is useful to show tools, lamps, and so forth to the children and to tell them how such devices can be used effectively and safely. The teacher can explain and demonstrate how even a blunt knife can be dangerous if improperly used. The children should be instructed to have adults sharpen pencils for them, or to use a pencil sharpener if one is available. They should not be permitted to carry knives. Unless the scissors have blunt ends they should be used only under adult supervision ('a' above).

The dangers of fire can be vividly brought to the children's attention. Older children may be invited to class I to demonstrate safe and unsafe ways of handling fire. The teacher may tell children stories about how a boy's carelessness may have produced a tragic fire. In a similar way children can be shown how dangerous a kerosene lantern can be. It is possible to arrange a demonstration where a kerosene lantern is tipped over and sets fire to the surroundings ('c' above).

Young children are very curious about matches and like to handle them. Teachers can demonstrate how matches can be used safely. They can show how children may get burns through unskilled use of matches. Stories can be told of how children playing with matches have set fire to a thatched roof or even to their own clothes. ('e' above).

Children at the class I level like to imitate their mothers and try to cook their own chapatis. In so doing they often burn their hands. They should be encouraged to wait a year or two before they begin handling food near a hot stove.

Teachers should make it clear to the children that rules of safe behaviour are not things just to be memorized. Rather, they are kinds of behaviour which should be followed at all times and at all places by people. When the children see the logic underlying such safety rules as these, they are more apt to accept them and follow them.

6. BATHING

Most children take a bath every day. Cleaning the teeth and the mouth and taking a bath is a part of the daily routine for keeping healthy. There are many holes or pores in the skin. Through these holes, water and some oily substances leave the body as sweat. Water evaporates from the sweat leaving behind salt and grease. At least once a day it is necessary to remove the layer of salt and grease by bathing and rubbing. Unit 11 is primarily concerned with 'Safety and First Aid'. The hygienic aspects of bathing are taken up in unit 10, 'The Human Body, Health, and Hygiene'.

Here are some desirable patterns of behaviour which concern children of class I while they are bathing or swimming:

a) Bathe only in clean water.
b) Use soap to get the body clean.
c) After bathing rub your body thoroughly.
d) Go into a pond, tank, etc., only when an older person is close by.
e) Bathe only in shallow waters.
f) Stay away from the edge of a swimming pool unless you are prepared to go swimming.

As with the rules of safety in other areas, the teacher has to help the children to understand the advantages of following these and other such rules as a matter of habit. For example, bathing in dirty water may lead to a skin disease or some other illness ('a' above). This may be discussed in the light of the experiences of the victims of such diseases. Stories may be told or suitable news from the locality may be discussed.

Besides using clean water for a bath, it is necessary to use soap for washing the skin, and to rub thoroughly after a wash ('b' and 'c' above). The usefulness of these habits may be discussed. Soap removes dirt and grease from the skin, and rubbing opens the pores of the skin and stimulates blood circulation. Through demonstrations, the teacher can help the children to develop these habits.

Taking a bath inside the house under a tap or with a bucketful of water is not risky. But bathing in a stream or a river is a different matter ('d' and 'e' above). It is great fun to bathe and swim in rivers and tanks. But then, it involves some risk. Through discussion the children can be helped to learn to combine the urge for recreation with the need for safety. They should never bathe in a river or stream without the supervision of an adult, and they should always bathe in shallow waters.

7. USING ELECTRICAL EQUIPMENT

In India there is hardly any city or town which is not electrified. Many of the villages also are provided with electricity. The use of electrical equipment for daily household purposes is becoming increasingly common. Children watch these appliances and the uses to which they are put. They love to handle them, in imitation of their elders, and are curious to know about them. But they are not aware of the danger accompanying such electrical equipment.

At class I level it is very essential that the children should learn about the dangers of handling the common electrical equipment in the house as well as in the school. The children need more than just the 'rules' of using electrical equipment. They also need to understand the logic behind these rules. This knowledge should be given in such a way that it influences the behaviour of the children. The following are some suggestions on which the behaviour patterns may be developed during this class level:

a) Do not touch electrical equipment like stoves, pressing irons and heaters.
b) Always keep your hands away from electric wires.
c) Play away from the poles which support electric wires.
d) Keep away from electric outlets.
e) Keep the hands away from electric table fans.

The above rules and suggestions can be given to the children merely as knowledge. But these instructions can be effective and fruitful only if the children understand *why* they are true. They can be helped to see that these instructions are for their own safety and benefit. This realization may make the children practise them at all times.

The teacher might first of all collect information about the electrical equipment being used in the local area. Then through discussion he can help the children to know about such equipment and the uses to which it is put in the homes in their area. Instructions for using these can be given through demonstrations. The teacher should have some common electrical equipment brought to school and actually show how it works ('a' and 'e' above).

Teachers can make safety principles clear through story-telling. Thus, a story may be told about a boy who touched an electric wire in his house and became unconscious with the shock. Or, perhaps there is a case of a boy whose carelessness caused his tragic death. A similar story may be told about a girl who put a paper clip in an electric socket and recieved a serious electric shock. Help the pupils to conclude at the outcome of the discussion that they should not touch the electric wires and should keep away from electric outlets ('b' and 'd' above).

The teacher may invite the attention of the children to the electric poles around which they like to play. Sometimes they try to grip the pole or they strike against it in order to get a musical note. A story from the teacher about how a farmer and his bullocks were electrocuted by an electric pole fixed in his fields will bring this home to the children. After discussing, let the children conclude that it is dangerous to play with the electric poles near the house or in the street. The children may be asked if they have observed the figure of human skull labelled 'danger' fixed on the electric poles. They can be urged to count the number of such electric poles in their area and to tell the number to the teacher the following day. By doing so the children will become really conscious about these rules of safe behaviour ('c' above).

The teacher can hold a discussion regarding heaters and stoves used in the home. Some children may have observed the wires of the heater becoming red-hot when the heater is being used. Or, they may have seen that a piece of paper or match-stick thrown over it catches fire. This thing may be brought to the notice of the other students who may not have seen these things for themselves ('a' above).

It is amusing for the children to see and to touch a moving fan. The teacher should point out that the moving blades of a fan are so dangerous that these may cut the fingers of a hand if one is careless ('e' above).

If possible, the teacher may show a moving fan in which a soft thin stick is inserted. The noise of the stick breaking will be exciting to the children. It will also make them realize that the same thing may happen to their fingers if they are put into the moving blades of the fan.

Through first-hand observations such as these, children can see the logic behind the rules of safety as regards electrical equipment. Sometimes they can be helped to formulate useful rules of their own. When children really understand such rules, they remember and accept them. This is the best way to lead children towards sound habits of safety.

UNIT 11

SAFETY AND FIRST AID

CLASS II

Overview

As in class I, the organization of this unit here at class II level is somewhat different from the other units in this syllabus. Whereas other units are organized on the basis of scientific principles, the organization here is on the basis of desirable behaviour patterns for safety and well-being. Although there are scientific principles involved, many of them are too advanced for the class II children. Therefore, the emphasis is on behaviour patterns rather than on understanding of scientific concepts.

In view of this, there are relatively few activities organized as actual investigations. This does not mean, however, that the material in this unit is simply to be narrated to the children to be memorized. There are many useful activities which can help the children understand these 'rules of safety and first aid'. In some cases, they can be helped to develop such 'rules' on the basis of their own observations and logic. Behaviour patterns which are developed by the students themselves are much more effective than those imposed by a teacher or other adult. The effort of teaching in this unit, then, should be based on having the children understand and accept the wisdom of the behaviour patterns; in this way they are much more apt to follow them.

As in class I, the behaviour patterns are divided into seven areas as follows:

1. Walking and running
2. Cycling
3. Riding in a bus, rickshaw, or tonga
4. Playing games and being with animals
5. Working with tools, stoves, lamps, etc.
6. Bathing
7. Using electrical equipment.

For each of these areas, this teacher's handbook provides some suggestions for making the teaching-learning process both effective and pleasant.

1. WALKING AND RUNNING

The children are now acquainted with some rules for walking safely. Their acquaintance with these rules has developed into a habit. They see the importance of following safety rules for their welfare. In class II, the children will be encouraged to build up some more behaviour patterns. Many of these are in respect of moving vehicles.

Since the children are now older, they have greater opportunities for moving outside their homes. Children in towns and cities may need to cross the streets several times a day. Having developed some confidence in their capacities, they may like to play with moving vehicles. In view of the above, some rules are suggested. These rules are:

a) Use the safest and shortest way to and from school.
b) Look carefully both ways before you cross the road or street.
c) Carefully observe traffic signals and street signs.
d) Walk when the light facing you is green; green lights mean 'go'; red lights mean 'stop'; yellow lights mean 'wait'.
e) Keep away from all moving vehicles.

An analysis of the above rules will help the teacher to convey their significance to the children so that they may accept them as a matter of habit. Rule (a) is a continuation from class I, where going to school was an important part of out-of-home walking. Since children have to go to school almost daily, they can easily grasp the advantage of (a). Rules (b), (c) and (d) are about the crossing of roads. One should not cross a road while a moving vehicle approaches. That is why one has to look both ways before crossing the road or street ('b' above). The teacher may emphasize that it is always better to wait and let the vehicle pass. Roads should be crossed at a steady walk (not run) when no vehicle is coming from either side.

The children should be told about traffic signals and street signs: what they are like, for whom they are meant, and what their significance is ('c' and 'd' above). Children should be told about the significance of the green, red and yellow lights ('d' above). The teacher may invite children to see how city traffic is controlled in order to let them appreciate the meaning and utility of traffic signals and street signs.

Sometimes, it is not carelessness but ignorance that causes an accident. For example, a child may not know how dangerous it is to touch or hold a moving vehicle while he is at rest on the ground ('e' above). Here is an area where the children should be helped to develop an understanding as well as a habit.

One of the aims of education is to develop children into good citizens—persons who feel a sense of responsibility towards the group to which they belong. The children should be helped to feel concern for the safety of others in the community. They may be helped to see the logic of this argument in this way. Suppose I cross a street so that there is no danger to myself. Yet I may cause danger to a car-driver by making him turn sharply to avoid me. Everybody, including myself, will be safe only when all—including myself—behave in a responsible way by not creating dangerous situations.

It should be emphasized from the very beginning that the habits of safety are to be practised at all times. Negligence—even for a moment—may cause irreparable damage. If a child crosses a busy road, say, twenty times a day, he cannot afford to cross it carelessly even once.

It is best to be so careful that accidents never happen. This demands a great deal of intelligence and foresight in children. They should be able to anticipate danger and accidents. The teacher may help children to develop this capacity for anticipation of accidents by discussion and demonstration. For example, if a boy is running fast, and a small boy tries to hold him, he will surely fall down. Similarly, the results of not following the traffic signals may be discussed.

The rules of walking safely on the road are not simply pieces of information that should be memorized. They are to be constantly practised so that they almost become second nature. Proper habits, developed and strengthened early in life, will persist throughout. Here is a vital role for primary school teachers in the development of the future citizens of India.

2. CYCLING

There are well over 10,000,000 cycles in India. There are more cycles per thousand persons in this nation than in any other nation in the world. This means that cycles are a very important means of transportation. It also means that they are a source of danger—both to their riders and also to other persons on the roads.

In class I, the children have had an introduction to cycle safety. There, the emphasis has been on their being taken for a cycle ride by an adult. But here in class II, many of the boys are beginning to learn to ride for themselves. Accordingly, the emphasis here is different. These children need to know of the dangers which come with the fun and convenience of riding a cycle. These are dangers not only to themselves, the riders, but also to others. Some of the things to be learned here concern the effective handling and care of the cycle. Other instructions are related to riding a cycle safely along roads crowded with people walking, and with many kinds of vehicles.

Here are some principles of cycle safety, appropriate at this class level:

a) Cycle only in safe places.
b) Hold the handle-bar firmly with both hands.
c) If objects must be carried on the cycle, use a wire basket or a luggage carrier; the hands must be free for the handle-bars.
d) Keep a safe distance from objects and persons.
e) The carelessness of other cyclists can cause injury; watch their movements carefully.
f) Learn and use the correct signals.
g) Keep the cycle in a safe place when not in use.

As always, in teaching desirable behaviour or patterns for safety or for health, memorization is neither the only way nor the best for students to learn. Children often abhor memorization. If they are required to memorize desirable behaviour patterns, they sometimes learn unconsciously to hate not only memorization, but also the material to be memorized. This kind of learning defeats its own purpose.

In helping the children to learn this kind of material, teachers should take full advantage of children's ability to reason and their respect for common sense. For example, children can see the logic of keeping far enough away from others to be safe ('d' above). Or, it is easy to appeal to their reason that making proper signals is a good thing to do ('f' above). In addition, they may be shown examples of adults driving cars or scooters or bicycles. Children at this age love to imitate their elders. So they can be helped to acquire good signalling habits if they are told that older people—including those who drive cars—also do this.

Here, as in class I, it is a good idea to have some demonstrations with a bicycle. Sometimes this can be done in the classroom; sometimes it must be done out of doors. Holding the handle-bars firmly ('b' above) can be easily demonstrated. A teacher can even demonstrate the unhappy results when one does not follow this rule of good cycling behaviour. Good use of signals ('f' above) and proper care of the cycle ('g' above) can also be demonstrated with the aid of a cycle.

Teachers should make use of direct class observation or of roadway situations involving cycle traffic. The class can be taken to a busy part of the road and permitted to watch the difficulties which cyclists have in heavy traffic. While there, the children can be urged to take careful note of examples of good practice and also of bad practice which they see.

Throughout all this, emphasis can be laid on the value of anticipating troubles and taking precautions to prevent or avoid them. Thus the children can be helped to see the value of looking well ahead while cycling and of making sure that the brakes are in good working order before starting out on a cycle trip.

All these teaching techniques avoid the errors of depending on rote memorization of desirable behaviour patterns. Instead, teachers should try to help the children to *understand* these patterns and to accept them as things they really *want* to do. If understanding and accepting and wanting are not achieved, more memorization will do no good in terms of permanent behaviour patterns. But if the children really understand and accept these 'rules' then memorization is not necessary.

3. RIDING IN A BUS, RICKSHAW, OR TONGA

Rickshaws and buses are inexpensive means of carrying children from their homes to schools and back. Even when the parents are very poor, they sometimes prefer that their children should go to and come from school under the charge of a rickshaw driver or bus conductor. Some parents are not aware of the dangers which exist under these conditions. Teachers at this class II level have a responsibility for teaching the children about safe practices while riding in a bus, rickshaw, or tonga.

In class I, the children have learned about certain good behaviour patterns to follow while riding in a vehicle. Here in class II, the children are a year older and are more anxious to handle the various parts of a vehicle. Being stronger now, these children often try to do things without assistance. They may try to enter or leave a bus without support from the doors or handrails. They may try to get out of a bus before it comes to a dead stop. Sometimes they try to run after a rickshaw or a bus and cause themselves great harm.

Here are some patterns of safe behaviour which might be taught to the children at this class level:

a) Use the safety bars while getting on or off a bus.
b) Get on or off a bus only after it has come to a dead stop.
c) If you must stand in a moving bus, get hold firmly on to the bars or to the back of a seat.
d) Respect the authority of the bus driver and the conductor.
e) Enter and leave the bus quietly and in single file.
f) Keep hands away from the wheels or

any other part of a vehicle while it is moving.

There are many ways of helping the students to understand the reasons for safety rules such as the above. For example, the children may be engaged in a discussion of questions such as:

1. What happens if you get into a bus without holding the safety bars and the bus suddenly moves? ('a' above)
2. What happens to a boy standing in a bus but not holding on to something if the bus stops or starts suddenly ('c' above)
3. Why is it important to enter a bus quietly? ('e' above)

The teacher can also tell stories about children who have had accidents because they violated rules like those given above.

The teacher may invite a bus driver to come and talk to the children. He should speak in such a way as to make the children feel that he is their friend. He might discuss how the children can help him to do his job better. He can also point out how he can make the rides safer and more comfortable if the children behave as they should. The teacher can point out that this driver has authority and experience ('d' above) and that the children should be quiet enough in and around the bus so that they can hear the driver's instructions ('e' above).

These instructions concerning moving vehicles are not merely matters for classroom discussion. It is very useful to take the children for a walk where such vehicles are in use. The children can be urged to observe the passengers in these vehicles. They can observe and tell those things the riders do which are dangerous and also those which make for passenger safety.

In some schools a bus or some rickshaws come regularly at the beginning and the end of the school day. The children should be supervised by the teachers when they get off and on these vehicles. The teachers themselves as well as the older students can handle this supervision. In addition, teachers and older students should set good examples of desirable behaviour.

4. PLAYING GAMES AND BEING WITH ANIMALS

Children very much like to play. Play provides a great deal of excitment and exercise for them. They play many kinds of games. Often they play among themselves (e.g., hide-and-seek) without any play material. Sometimes they play with some special equipment (e.g., *gilli-danda,* football, fireworks). Occasionally they involve animals in their play.

In class I, the children developed some patterns of behaviour based on the selection of safe places for play. Besides the possible danger in the places where children play, there may be risks involved in the kind of play itself. Pushing and rough playing may, for example, result in serious falls causing cuts or even bone fractures. Throwing sand balls or sand may seriously hurt the eyes. A few rules about playing safe games are listed below:

a) Do not take part in pushing and rough play.
b) Do not throw sand balls or sand.
c) Keep away from stray dogs.
d) Do not tease and irritate animals.
e) Stay away from lighted fireworks; handle them carefully; use them only in the presence of an adult.

The above patterns of good behaviour are not to be given to the children as rules to be memorized. Rather, the discussion is so directed that the children are themselves able to formulate these rules, and then accept them as of their own making and for their own good.

Why is it necessary to always play safely? If a game is risky and does not harm on one occasion, that is no guarantee that it will not do harm at another time. The injury due to a single accident may have lifelong effects. The teacher can use this kind of reasoning to discuss with the children that it is always good to play safely.

If a boy receives injuries because of rough play, it may be pointed out that prevention is better than cure. The children should be encouraged to anticipate dangers in such situations as throwing sand balls or sand, playing with stray dogs, teasing animals, playing recklessly, playing with matches or fireworks, and so on. Anticipating dangers is always helpful in avoiding accidents.

Besides liking to play with some animals, children—especially in villages—often work with animals. This requires an elementary knowledge of the habits of common animals. It may be found very helpful to discuss with the children how common animals protect themselves, how they get irritated, and how they can harm people. For example, some animals have horns, others protect themselves by kicking with their hind legs, and some others may bite when irritated. The teacher can develop these ideas in the children by showing them the animals or by vivid stories on these themes. It will also be helpful to interview persons who have been attacked and injured by irritated animals (d' above).

The spirit of adventure has its own attraction. If no risks are ever taken, life may become very monotonous. Small risks may be undertaken by children with suitable precautions. For example, playing with fireworks is hazardous. Even then, children greatly enjoy this play. The teacher can discuss that it is comparatively safe to play with fireworks in the presence of some adult ('e' above).

There should not be any attempt to ask the children to memorize these rules. Through discussion, demonstration or interviews the teacher should help the children to understand these behaviour patterns and to accept them because they are for their own good.

5. BATHING

Ours is a semi-tropical country. The climate is such that children as well as adults feel refreshed after a bath. Children like to bathe and swim in running water such as a stream or river. But this pleasant activity of bathing and swimming involves some risks. It is, therefore, necessary to help the children to realize the dangers and to develop good patterns of safe behaviour in this area.

Some patterns of safe behaviour related to bathing and swimming are:

a) Do not run or play on the wet floor in a bathroom.
b) Do not run on the wet surface near a pool or tank.
c) Get out of the water before getting tired.
d) Swim only where there is someone else swimming or watching.
e) Avoid swimming immediately after

meals.

f) Learn to swim.

In their previous class, the children have been helped to develop some good habits about bathing—using clean water and soap for a bath, rubbing the body briskly after a bath, and so on. In this class the children are a bit older and may be learning to swim. In class II, the emphasis is on safety while bathing and swimming. The discussion might centre around these points:

1. One should develop the habit of anticipating accidents.
2. Prevention of accidents is an important part of safety and first aid practice.

For example, 'd', 'e' and 'f' are checks against drowning, for the child is not always able to cope with the stream of water. The rule 'e' is good because swimming (in fact any strenuous exercise) immediately after meals impairs digestion. Sometimes children, against the advice of their elders, continue playing and bathing in the water for a long time. This may make them so exhausted that it becomes unsafe. Or, they may catch cold and fall ill. The children may be encouraged to narrate such experiences to help them to understand and accept the habit ('e' above).

The children know from their own experience that wet surfaces are slippery. Some of them may be encouraged to relate past experiences of falls while running or walking on a wet surface. They may not, however, know that such falls may sometimes (e.g., near a pool's edge), be very serious. The teacher can bring this out by narrating related news or stories.

The importance of walking cautiously and slowly over a wet surface can also be demonstrated through an activity of this type. The children can have a competition of swift walking (but with no fall) over a dry surface and then over a moist and slippery surface. They will find that avoiding falls, while walking on slippery, moist ground, needs greater care and more time. In this way help the children to understand rules 'a' and 'b'.

Patterns of good behaviour cannot be taught by verbal means alone. The children may be invited to visit fairs by a riverside when many people are taking their bath in the river. Let the children examine critically the behaviour of young children bathing in the river. If there is a water accident, it may be discussed with the children.

6. WORKING WITH TOOLS, STOVES, LAMPS, AND SO FORTH

Children love to handle tools and other equipment around the house. They see adults do this, and they like to imitate them. But tools—particularly sharp ones—can be very dangerous. It is important that the children should learn safe rules for handling such devices.

Good safety practices when handling tools and small equipment are partly matters of safe use. In addition there are some tools which children must not use because they cannot do so safely. Children can use tools—and learn to use them effectively—provided that they have adult supervision. The number of tools available to young children in our country is not large. One of the purposes of education is to help the children to learn to use different kinds of tools and to use them safely. Accordingly, this section of the Unit is not only concerned with children's safety, but also with helping them to know more and more about the effective use of different kinds of tools.

Here are some suggestions which can lead towards desirable behaviour patterns for children at the class II level :

a) Do not play with tools; use them only for the purpose intended.

b) Be very careful while using tools which are sharp or heavy or expensive; these should be used only under supervision.

c) Keep a safe distance from fire; do not touch a burning stove.

d) Stay away from burning lamps; these should be moved only by adults.

A good way to teach about the safe and effective use of tools is to demonstrate them. The teacher may bring a few common tools to the classroom and show how they are used. These might include knives, scissors, tongs, and hammers. The children may be shown how these can help to do common tasks. The teacher can also show how some of these tools can be dangerous ('b' above). The teacher can show how dangerous knives can be. A knife can easily cut hard wood, or a dropped knife may cut a big dent in the floor. These demonstrations will impress upon the children the dangers that can result from sharp tools like knives. Some other common devices are also sharp. These include things like needles, pins, forks, or even sharp pencils. All of these should be used with great care. ('a' above).

Many Indian homes have fires burning inside or close by outside in the courtyard. Particularly when it is cold, children love to huddle close to the warm blaze. They should be warned of the danger of having their clothing catch fire. This danger can be demonstrated by wrapping a stone in loose dry cloth and placing it close to a flame so that it catches fire. If clothing does catch fire, the best way to put it out is to roll on the floor or on the ground or to cover the burning clothing with a rug or something similar ('c' above). This can be demonstrated with the burning cloth around the stone.

The teacher can easily demonstrate safety with oil lamps. The children may be shown the safe way to light these. They should be strongly advised never to put oil in a lamp while it is burning. They should be reminded that a lamp is really a movable source of fire. If it is dropped or tipped while being moved, it may produce very serious results ('d' above).

If children are given opportunities to observe tools, stoves and lamps being handled by safe methods they can compare these with the dangerous practices. With care, the teacher can help the children to identify the rules of safe behaviour by themselves. When the teacher succeeds in this, he has a situation where the children automatically accept the rules as being worthwhile. Children—like adults—have great respect for their own ideas.

7. USING ELECTRICAL EQUIPMENT

Children find it difficult to resist the temptation of touching or handling the beautiful electrical household equipment which is used by older persons. They like to do the same thing and act in the same way as their elders. Electrical appliances such as heaters, electric stoves, pressing irons, electric fans, electric lamps, etc., are some common examples of household electrical equipment. Knowledge about these articles is very essential because handling them carelessly can be very dangerous.

In class I, the children have developed certain behaviour patterns of not touching or handling such equipment in the house or in the school. In calss II, they may be permitted to handle certain equipment with great care and with extra precautions. They should know the reason for all the precautions which should be followed.

Some of the rules and the suggestions which should be followed by the pupils while handling electrical equipment are:

a) Never touch electrical equipment with wet hands.
b) Do not put wires or sticks into electric switches and plugs.
c) Keep a safe distance from an electric heater or a pressing iron.
d) Do not step on electric wires; do not handle them unnecessarily or play with them.
e) Always stand on a dry spot while using an electrical appliance.
f) Stand on a wooden article or use rubber shoes while switching the light on and off.
g) Do not bother an electrician while he is making electrical connections and repairing the electrical equipment.

Through discussion and by observing individual children the teacher should find out to what extent the behaviour patterns have been developed among the children during class I. He should emphasize the rules already learnt in class I under 'a', 'b' and 'd' above and should extend these for explaining 'c' above. The children may be told that if one must handle these articles of electrical equipment such as the heater, stove, or iron press, he should touch them with dry hands ('a' above). If the children are told the reasons for this they are more likely to understand the rules. Water—even a little moisture—does conduct an electric current. Therefore, if someone handles electrical equipment with wet hands, some of the current may go through his body. This will not happen if the equipment is in perfect condition. However, one should not take so great a risk. In the same way, a person using electrical equipment may become a part of the circuit if he stands barefooted on the ground or on a stone floor. Therefore, it is safest for children to stand on a board or on a wooden chair or on a bed while using electrical equipment ('e' and 'f' above).

The children should be sternly told that electricity is more than merely a source of pain. Every year many people in our country and in other countries are killed by electric shocks. Most of these are due to handling electrical equipment with wet hands or while standing in a damp place.

Quite often electrical appliances are used even if they do not have a plug at the end of the wire. Unfortunately it is common practice simply to insert the wires in the electric socket. This is extremely dangerous. If there are electrical appliances in the school, the teacher should set a good example by having sturdy electric plugs on the wires of all appliances ('b' above).

If an electrician comes near the school to work, invite him to talk to the children on the safe use of electrical equipment. Perhaps he will permit them to watch while he does some of his work. However, they should watch quietly, so that he can concentrate on his important and dangerous work ('g' above).

A properly installed electric switch should not be a source of danger. Sometimes, however, these are not properly installed.

or they may have become dangerous through use. To be very safe, young children should stand on a board or on a chair while turning an electric switch on or off ('f' above).

As our country becomes more and more developed, children will be using more electricity and a wider variety of electrical appliances. The teacher should try to tell the children about the increasing use of electricity which will take place during their lifetime. They should be helped to realize that greater use of electricity is not only a matter of personal convenience, but also that it contributes to the strength of this nation. The children should be helped to have two kinds of respect for electricity—respect for how its energy can help people, and also respect for the great danger it presents to ignorant or untrained people.

UNIT 11

SAFETY AND FIRST AID

CLASS III

Overview

This unit is different in character from the other units in this teacher's handbook. It is more concerned with day-to-day patterns of safe behaviour than it is with the scientific principles underlying such behaviour. While there are scientific principles involved, children at this class level are not mature enough to understand them. And their safety cannot wait until they are old enough to understand !

The emphasis here, then, is not on experimentation. Rather, it is on the logic and common sense which underlie good patterns of behaviour for safety and first aid. The teaching methods suggested are aimed at helping the children to understand the benefits of following good practices, and the unhappy results which often follow when these rules are broken. In many cases, the children in class III can be helped by the teacher to develop useful safety rules for themselves. When the teacher succeeds in doing this, the children have rules which they accept because they made them. Then the enforcement of the rules is scarcely necessary.

As in classes I and II, desirable behaviour patterns here in class III are divided into seven areas thus:

(1) Walking and running
(2) Cycling
(3) Riding in a bus, rickshaw, or tonga
(4) Playing games and being with animals
(5) Working with tools, stoves, lamps, etc.
(6) Batching
(7) Using electrical equipment.

In each of these areas, specific suggestions for effective teaching procedures are made. In this treatment, class III is a continuation of the ideas developed in classes I and II, with modifications, because of the increasing maturity of the children.

1. WALKING AND RUNNING

Man usually moves from one place to another on the earth's surface by walking or running or by riding in vehicles. Since children must often cross roads and streets in their daily lives, it is necessary to encourage them to practise rules for safe walking and running.

In their previous classes the children have learnt some useful patterns of behaviour for walking. They walk only on the foot-path or on the right side of the road. When necessary, they cross the road or street after carefully looking both ways to see that no vehicle is approaching them. They have also had their preliminary lessons on traffic signals and street signs.

Most of the rules and patterns of behaviour discussed at the class III level are concerned with safety on the road. One is related to walking in fields or on the grass. These rules are listed below :

a) Keep away from moving vehicles.
b) Play away from roads and streets. They are meant for traffic and not for playing.
c) Obey the traffic signals and directions of the traffic constable.
d) Before crossing the street, wait for cars, buses, rickshaws, and other vehicles to move on.
e) Walk; do not run across the street. If you run, there is the danger of falling.
f) Be careful on wet roads; they can be very slippery and dangerous.
g) Be careful when walking in tall grass or weeds; there may be holes, snakes, or insects.

Most of these rules follow from common sense. It is better if the children are helped to formulate by themselves these rules of safety during walking. The teacher can assist the children in imagining dangerous situations—leading them to arrive at rules of safety. For example, a dog run over by a truck may be shown, or the situation may be described to stress the importance of 'a'. A story may be framed and narrated highlighting the danger of walking in tall grass ('g' above). Sometimes the need for these rules can be stressed by actual news from the locality.

Sometimes children think that all open spaces, including those on the roads, are equally good for their playing. It may be discussed with them that roads and streets are not for playing or running (as a sort of play) even though no moving vehicle is visible on the road. Any moment a bus, car, cycle, etc., may arrive and cause injury ('b' above).

There is a point to be discussed about obeying the traffic signals and directions of the traffic constable ('c' above). They are not to be looked upon as limits or restrictions on children's freedom. The children may be invited on a trip to see how the traffic constable regulates the traffic. It would be very interesting for the children if an interview with the traffic constable can be arranged. If he is able to narrate from his personal experience some incidents caused by negligence of traffic rules, the children will be highly impressed with the need for following traffic rules.

The children may be encouraged to look at newspapers and compile a list of accidents on the roads. The causes of these accidents may then be discussed. Suggest how the accidents could have been avoided by a little carefulness and foresight.

In spite of the best care, accidents sometimes do happen. When a moving cycle knocks down a boy walking across the road, it is useless (so far as the victim is concened) to discuss how the accident occurred. Help in the form of first aid must be immediately given to him. Since children are unable to give all the necessary first aid, it is always a good habit to report about injuries and accidents immediately to the authorities of either a police-station or a hospital. If these are far away, any adult in the neighnourhood may be informed.

No good purpose will be served if the children are asked to memorize these rules.

They often hate rote memorization, and this attitude is likely to be transferred to these rules. Rather, they should be helped to see the logic behind these rules for maintaining safety. This will make the rules more acceptable to them.

2. CYCLING

By the time the children are in class III, many of them will be using cycles quite a bit. They should be encouraged to increase their ability to cycle carefully; however, this should be done under conditions where there are no traffic problems. Children at this age often need restraint to keep them from imitating adults too thoroughly. The teacher can help by urging the children to handle cycles only to the degree they can do so effectively, and to look forward to the time when they are older and bigger, and can become expert cyclists.

Here are some behaviour patterns related to cycling which may be learnt by the children in class III.

a) Always ride a cycle slowly enough that it can be controlled completely.
b) Learn to use the brakes effectively.
c) If you ride on a road, always ride on the left side, well over to the edge.
d) Learn to give correct signals while cycling, even where there is little or no traffic.
e) Obey all traffic signals and road signs.
f) When a busy road must be crossed, get off the cycle and push it across.
g) Ride only in the daytime. Do not ride on busy roads.
h) Do not take anyone for a ride on a cycle.
i) Ride in single file; do not ride beside another cycle.
j) When you stop your cycle, get well off to one side; do not remain on the road.
k) Do not hang on to a bus or truck or scooter while you are riding a cycle.
l) Do not have a contest or play tricks or games while riding a cycle.

A good way to make the children see the reasons for such rules is to have them observe actual cycling situations. For example, if they can be taken to a busy street, they can see what happens when a cyclist stops in the middle of the road ('j' above). They can also see how helpful it is to everyone when correct signals are given ('d' above).

The children should be helped to realize that good patterns of safe cycling behaviour are not things to be followed only during special situations. They should be urged to follow these safe cycling patterns at all times. To encourage this, the teacher may ask the children to describe good or bad cycling practices which they have followed or which they have seen in others during the afternoon and evening.

The best thing to do about accidents is not to have them. This can be achieved only by constant care and attention. The teacher can encourage this by getting the students to report occasionally on how long they have gone without being involved in any accident. Those who have good, accident-free records should be praised. Some teachers like to keep an accident chart for the class as a whole.

When accidents do occur it is important that action be taken promptly and properly. Children often do not know what to do when they are at the scene of an accident. Although they may not know the details of good first aid procedure, children can help by getting out of the way, by not asking questions, and by helping adults in any way possible.

The class III children by now have some substantial ability to read. At this level then they can be urged to read road signs ('e' above). In this way they can not only improve their reading, but can become aware of traffic rules and regulations.

Some teachers have had successful experiences in having a 'cycle safety show'. Pairs of children can use cycles to show the contrast between good and bad patterns of cycling behaviour and cycle care. This is an effective way to demonstrate and dramatize the techniques of safe and effective cycling.

3. RIDING IN A BUS, RICKSHAW, OR TONGA

By the time the children are in class III many of them may be coming to school in a bus or other public vehicle independently. They would also like to do this while going to places other than the school. It is important that safe behaviour patterns for such riding be developed so that they will apply in all such situations, not merely in those related to the school.

Children of this age are more inquisitive to know about how a vehicle works. They want to know how it starts, how the horn blows, how the brake is applied, and how the steering mechanism works. Quite natually they ask many questions of the driver, sometimes interfering with his safe control of his vehicle. Sometimes children play with the horn or other parts of the vehicle if the driver is not there. Children's habits concerning vehicles should be such that these things do not happen. Here are some suggestions around which safe behaviour patterns may be organized.

a) Get on and off the bus only at regular stops.
b) Tell the driver if the door is not properly closed; do not lean against the doors of the vehicle.
c) Keep arms and hands inside the windows of the vehicle.
d) Do not play with any parts of the vehicle; do not touch any moving parts.
e) Do not disturb the driver while he is driving.
f) Leave the bus as neat and clean as you found it...or even cleaner!
g) Form a queue at the bus stop; stand in line without pushing.

If the children are to behave according to these suggestions, it is necessary that they understand the logic behind them. If they understand this, they will realize that the rules are for their own good. One way of developing this understanding is through discussion, rather than mere memorization of the rules.

Since the children are interested in moving vehicles, they are glad to have a chance to learn about them. The teacher can get a bus driver to show his bus to the children. In particular he can point out the functions of the various parts and how they work. He can also indicate which parts of the bus are dangerous ('d' above). At the same time he might point out how children can help by telling him about dangerous situations ('b' above) and by not disturbing him while he is driving ('e' above).

Keeping the bus clean and neat is a part of good citizenship. The children are required to help in keeping the classrooms and the school yard clean. In a similar way they can be asked to help in keeping the bus clean. If the bus is provided by the school, the children may enjoy giving it a thorough cleaning once in a while ('f' above).

As in so many other cases of good behaviour, children are very apt to imitate the performance of older children and of teachers. Therefore, it is important that teachers and older children set a fine example for the little ones. Children also tend to take better care of things which they consider partly their own. Therefore, it is useful to refer to the bus or other vehicles as 'our bus' or 'our rickshaws'. On a day when the bus or rickshaws do not come promptly, the teacher can call the students' attention to the extent to which they depend on these means of transportation.

4. PLAYING GAMES AND BEING WITH ANIMALS

All children love to play. It provides them with physical exercise and recreation. Children are often so absorbed in playing that they are not able to anticipate accidents. They may step on a piece of broken glass or slip on a fruit skin. Here are some rules that will help the children of class III to play safely:

a) Always keep the play area clean.
b) Avoid playing on rough and rocky surfaces.
c) Keep the playground free from broken glass, fruit skins, waste paper and other rubbish.
d) Play a fair game; children who do not play fair may hurt others or themselves.
e) Do not play on roofs.
f) Put play equipment in a safe place after use.

The teacher may discuss the patterns 'a', 'b' and 'c' together. All these stress the importance of playing on a clean surface free from broken glass, rubbish, etc. Encourage the children to think of the hazards if the above rules are not followed. Stress the idea that prevention of accidents is an important part of safety and first aid practice.

Help the children to reason out why one should always play a fair game ('d' above). If the players do not observe the rules of the game honestly, the play may have to end abruptly with a quarrel among the players. Let the children understand that a game can be fun only if all play fair. If even one child does not play fair, it may hurt the feelings of others (leading to a quarrel) or cause physical injuries to them. Each child should treat others as he himself would like to be treated.

After the game is over, the play equipment must be kept in a safe place, and the play area must be cleaned ('f' above). For cultivation of these habits in the children, the teacher, after discussion of these points, should closely watch them during play. The boys and girls with desirable behaviour should be praised to strengthen their good habits.

Rules 'b' and 'e' may be discussed with the children by narrating stories of boys getting hurt by falling on a rough surface, or because they flew kites from a roof. They will thus see the advisability of preventing accidents or reporting about dangerous practices to the proper persons.

Even with the best care accidents sometimes do happen. Then it is important that proper action be taken promptly. Moreover, injuries should be immediately reported to parents, teachers or other adults in the neighbourhood. Good practice of safety and first aid includes understanding directions and following them carefully.

No amount of formal discussion or rote-memorization will ensure that the children develop these patterns of behaviour. They should be helped to understand these rules through discussion, demonstration, interview or field observation. Those who follow these rules without fail may be praised or be awarded prizes. This will strengthen their habits of safety, and will serve as a good example for others.

5. WORKING WITH TOOLS, STOVES, LAMPS, ETC.

Children imitate their elders and like to handle the tools which grown-ups commonly use in the house or in the school. They are very eager to learn to use these articles. But before such skills are taught to them, the dangers involved in their use need to be stressed.

In classes I and II, the children in school and at home have learned some good behaviours. Mostly they have been encouraged not to touch, not to handle, not to use dangerous household tools and school articles. But their curiosity to learn more and more about those tools and their enthusiasm to use them grows very strong in class III. It is here that they may be allowed to use some of the equipment. At the same time they can be helped to understand certain rules which are to be followed when using a particular tool or article. They are old enough to keep themselves safe from danger provided full knowledge is imparted to them. They are also able to do something avoid the hazards. Actually, in class III the learning of new behaviour patterns is not so much aimed at, as is learning to use some simple common tools. The following are certain rules which are to be followed under the guidance of the teacher:

a) Use tools very carefully.
b) Do not scatter tools while using them; after use keep the tools in the proper place.
c) Be careful with combustible material near a fire; this applies to dry paper and wood, and particularly to petrol, kerosene, and oil.
d) Be careful with loose, dry clothing near a fire; it burns very easily.
e) If a fire spreads, put it out with dirt or water; use dirt on petrol or oil fires.
f) Use cloth or tongs to protect your hands when working with hot utensils.
g) Play with fireworks only when an adult is with you.

The above rules should form a natural part of the children's normal daily activity. Their behaviour should be moulded in such a way that the above rules become habits.

The teacher may bring some common tools such as a knife, scissors, hammer, some electrical appliances, a stove, hot plates (*tava*), forceps, needle and thread, and pieces of cloth. He may then give a demonstration of the use of these tools. He may point out how a knife, scissors and needle are used carefully and kept at their proper place after use ('a' and 'b' above).

The teacher can also demonstrate how to carry a hot utensil. Whenever a science investigation involves a hot object, the children can be challenged to find a way of handling it safely ('f' above).

The teacher can demonstrate the dangers of having cloth close to a fire. The children can see that thin, dry cloth can catch fire very quickly when near a fire or an electric heater. They will see that some of the synthetic fibres (nylon, terylene, etc.) are particularly dangerous. The teacher may discuss an accident in which a saree hanging near an electric heater, *angithi* or stove caught fire ('d' above).

The children should be encouraged to relate stories connected with the burning of such dry materials as cotton or grass lying in the courtyard near a fire. Also, some cases where a tragic fire was started by careless handling of petrol or kerosene near a flame or an electric heater may be discussed. Help the students to conclude that such materials catch fire quickly ('c' above).

The teacher may show the children some petrol, spirit or any other inflammable liquid. A quantity of petrol may be put in a shallow pan and set afire. If water is now thrown on the blaze, it spreads even more. Since water is heavier than petrol, it sinks and makes the petrol spread. Dirt, however, puts the fire out very effectively. ('e' above). This is because dirt not only cools the burning materials; it also smothers it, i.e., removes the fire's supply of air.

It is useful for the teacher to organize a fire-safety campaign for the school. The children can help to prepare a list of good safety rules. These can then be enforced by a fire-safety committee made up of the students themselves.

6. BATHING

The children have learnt to practise some good safety habits in their previous classes. They will be helped in this class to formulate some more safety habits related to bathing and swimming. A few behaviour patterns are suggested below:

a) Do not play games like hide-and-seek in the water.
b) Do not push or wrestle on the water's edge.
c) Be careful not to step on soap or other slippery wet material; it may cause loss of balance.
d) Always watch out for the safety of others.

The chances of getting injured due to a fall are greater on a wet surface than on a dry surface. This is because water makes a surface slippery. Soap under the feet further increases the likelihood of falling. A fall is likely under the above-mentioned conditions because it is difficult to balance on a slippery surface.

It is possible that one may bathe without following the above precautions and still not get injured by a fall. But he may not always be so lucky. Habits of safety should be practised at all times. If the pattern of behaviour is useful, it must always be practised so that it may become an unconscious reaction. Negligence may not do any harm at one moment, but at another it may a serious injury.

Encourage the children to discuss how playing games like hide-and-seek and pushing and wrestling in water ('a' and 'b' above) are dangerous. Some news or stories bearing on this may be told to the children. The children are thus helped to understand and believe in these rules.

It is a good idea to develop the sense of collective safety in children. One's own safety is closely associated with the safety of others. For example, a child should not throw a banana skin, because it may lead to injury to others, and ultimately to himself if others also do like-wise ('b' above).

It would be most fortunate if all accidents could be prevented. Accidents, however, do happen in spite of one's best efforts. It is very important that when accidents occur, proper action be taken immediately. The children may be helped to discuss what they would do if they see somebody drowning or falling on a slippery surface. Since they are young, they may not be of much direct help to a drowning person, but they can cry out and call others for help.

7. USING ELECTRICAL EQUIPMENT

Electrical equipment is becoming more and more common in the homes and schools of our country. These devices provide a saving of time in the kitchen and in other daily work. They also provide comfort and convenience. Children like to imitate their elders; they are curious to know more about electrical equipment, and they take great pleasure in handling it. It is essential that complete knowledge of the common household electrical appliances be given in such a way that the children put it into practice at all times. Since our country is developing so rapidly, there are many parents who themselves do not understand the safe use of electrical equipment. This means that teachers have a special responsibility in helping children learn about these newer ways of living.

While it is important that children know how to use electrical devices effectively, it is even more important that they know how to use them safely. Here is a suggested list of rules for the safe handling of electrical equipment.

a) Never use electrical equipment unless you are sure it is in good working order.
b) Connect and disconnect electrical equipment safely.
c) Never use an electrical appliance which does not have a plug on the end of the cord.
d) Handle electric cords carefully; do not twist or bend them; do not step on them; keep them out of water.
e) Never use an electrical appliance while standing in water or bare-footed on the ground or on a stone floor.

The children should learn the reasons behind these rules of safety as regards electrical equipment. They can be told how electricians have been seriously injured or killed when a heavy current passed through their bodies. The purpose of these rules of safety is to prevent the body from becoming a part of the electric circuit. Very often injury from electricity occurs because the appliances are not in good repair. Any appliance which is suspected to be faulty should be repaired before it is used ('a' above).

Many people in our country have the bad habit of using appliances without plugs on the end of the cord. They simply insert the bare ends of the wires into the electrical socket on the switch-board. The children should be shown how the very act of putting wires into the circuit's outlet in the socket may produce a dangerous shock. Furthermore, this practice is likely to produce electrical fires. Teachers should set a good example by having all school electrical appliances equipped with a proper plug on the end of the wire ('c' above). Another source of danger with electrical equipment is found in the cord to a given appliance. Often these cords become worn or cracked and the wire itself can be seen through the insulation. Lead wires which are twisted or bent or which are placed where they can be stepped on wear out very rapidly. Lead cords should never be placed where it is wet or even damp ('d' above).

It is common practice in this country to have a switch which controls an electrical outlet. Whenever an appliance is to be connected, the switch should first be turned off. After the plug of the appliance has been put in the socket, the switch may be turned on. If this rule is not followed, a faulty appliance may be connected and produce a spark or a fire at the electrical outlet. But if the switch is turned on only after the plug is inserted, the spark or fire will occur when the hands are well away from the source of danger. The children should be helped to see the logic behind this safety procedure.

It has been emphasized in the previous classes that electrical appliances should never be handled while the user is bare-footed and standing on moist ground or a stone floor. If he violates this safety practice, the user may be making himself a part of the electric circuit. This is because water—even dampness—is a good conductor of electricity ('e' above).

The children should be helped to realize how the uses of electricity are increasing in this country. They should be urged to talk with their parents or other adults in the village to see what life was like before there were any electrical devices. In contrast, the teacher can tell students about the large number of electrification projects now taking place in India. In this way, the children can be helped to see how rapidly our nation is developing.

UNIT 11

SAFETY AND FIRST AID

CLASS IV

Overview

Unit 11 is different from other units in this syllabus. It involves far more of the development of attitudes and habits and rather less of the learning of scientific principles and concepts. In contrast with other units, investigations are not used much in this unit. No one would like to be involved in an accident to learn how it happened or how it could have been avoided! The experimental approach is, therefore, not practical here.

The treatment of this unit here in class IV is different from the treatment in the previous three classes. No suggested activities were given in the previous classes. To help the teacher, activities (demonstration, discussion, observation, interview, etc.) were suggested in classes I-III as a part of the methodology of teaching some principles of safety. Here in class IV, in this unit, there is a return to the 'concept and sub-concept' pattern of treatment typical of entire teacher's handbook.

India is a developing country which is adopting technology in various walks of life. It is likely that the children of the present generation may have to use tools that their parents never saw. The precautions needed while handling electrical equipment may not seem very relevant to parents in a village. Yet the teaching of these precautions is important in view of the country's future, when most of the villages will be electrified.

An important idea in the first major concept is that safety precautions are necessary not only for the individual's good but also for the welfare of the community. For example, a fire which breaks out through the carelessness of one person may bring tremendous havoc upon the entire community. Safety precautions are as much a problem of social responsibility as of personal safety.

The second major concept of this unit deals with elementary first aid and emergency measures. Three sub-concepts concern bleeding and its after-care. One is about insect stings and insect poisons.

One of the principal outcomes of this unit should be the growth of children into responsible citizens of a rapidly developing country.

1. SAFETY PRECAUTIONS PREVENT ACCIDENTS AND INJURIES AND ARE ESSENTIAL TO INDIVIDUAL AND COMMUNITY WELFARE

Accidents are liable to occur anywhere. Travelling on busy roads, working with fire or electrical equipment and other mechanical tools, games and sports, swimming and other activities, all provide some possibilities for accidents that may result in injuries. Most accidents are the result of carelessness; they could be prevented by regular practice of safety habits. Being careful will not prevent or stop all accidents, but will certainly help to reduce them. This section will help the children to develop some simple concepts related to the prevention of accidents with reference to human welfare.

1(a). PRECAUTIONS ARE SPECIALLY NEEDED WHILE WALKING THROUGH BUSY TRAFFIC

Many children have visited a town or city in which they have seen some busy traffic. However, quite a number of them might have never seen a busy road crossing with signals and pedestrian crossings and people utilizing these facilities for their safety. If they have not yet seen these things, they may see these sooner or later. As a future citizen of the country, every child should be educated about walking through busy traffic so that he may make the following rules an integral part of his behaviour:

Be very careful while walking through busy traffic.

Look on both sides (right and left) before crossing a street.

Avoid stepping out into the street from behind or between parked vehicles.

Be alert for vehicles that are about to turn a corner.

Make use of the 'pedestrian crossing' if there is one.

Walk only on the 'go' signal.

Keep eyes straight ahead and be alert.

Learning experiences about walking through busy traffic can be provided through such activities as these.

Field Observation

How should we walk through busy traffic?

Take the children on a walk to a busy traffic area. Ask them to observe how people walk through the traffic and make note of safety precautions taken by them before or while crossing. If by chance some accident happens, ask the children to observe the possible reasons for it. Later in the classroom arrange a discussion and elicit safety rules to be practised while walking through busy traffic.

Help the children to develop their own rules, to be observed while walking through traffic to and from school, and to enforce these rules among themselves.

Help the children to act out situations such as a safe road crossing and accident prevention in the school playground or courtyard; others may be asked to comment on the acts.

1(b). PRECAUTIONS ARE NEEDED WHILE HANDLING FIRE IN THE KITCHEN

Fire is a common source of accidents in the home. Often there are reports in the newspapers about fires that have occurred in houses and in other places. Some of these fires take lives while others disfigure persons and make them invalids for the rest of their lives. Girls should be very concerned about the safe handling of fire and heat-producing equipment used in the kitchen. However, the boys also should learn about situations which can cause accidents connected with fire. The common causes of such accidents are:

Getting too close to a fire.

Blowing on the fire with the mouth instead of using the proper means for this.

Wearing loose clothes while sitting near a fire.

Keeping the hair loose while making a fire.

Wearing material which easily catches fire, e.g., shellac bangles, nylon clothes, etc.

Leaving a fire without making sure it is out.

The risk of accidents from fire can be reduced. To make the children understand how such accidents can be prevented, activities like the ones described below may be quite useful.

Familiar Experience

What are the situations in which accidents from fire can occur?

Ask the children to recall some of the accidents connected with fire in kitchens, either reported in newspapers, or seen around their homes. List these on the blackboard. Discuss why these accidents happened and how they could have been avoided.

Demonstration

What are the features of a safe kitchen?

Arrange a demonstration in the school. A kitchen can be planned with the help of students so as to exhibit the safe situations and the safe way of working with fire. This opportunity will provide practical and first-hand experience to the children regarding safe handling of fire in the kitchen.

Ask the students to list the precautions that should be taken while using fire in the kitchen.

Ask the students to observe any situations in the kitchens in their homes, which might lead to some accident or injury connected with fire, and to report in the class how they acted to take precautionary measures.

1(c). PRECAUTIONS ARE NEEDED WHEN HANDLING ELECTRICAL EQUIPMENT

With the increasing prosperity of the nation, electricity will reach every corner of the country. Even now many villages have electricity. Electricity is being used for agriculture and industry as well as in the home for various domestic purposes such as lighting, cooking and heating. Children need to learn safe ways of handling electrical appliances.

A person using an electrical appliance carelessly may get a shock which injures him and may even cause his death. Working with defective electrical equipment is dangerous. Even when such equipment is handled in the proper way, there are chances of getting hurt. For example, people have died of electric shock when they were working with a defective electric iron, or a defective table lamp. There are some very important safety practices which may help individuals to reduce the risk of accidents while handling electrical equipment. These are:

Handle electrical equipment carefully.

Be sure that the electrical equipment being used is in good condition.

Repair an electrical appliance only when you have full knowledge about it.

Use the equipment only in the proper way—do not experiment with it.

Always stand on dry wood or on an insulated surface while handling an electrical appliance.

Unplug the equipment after use.

Keep the equipment at a place which is out of the reach of children.

The electric current should be turned off before plugging in or unplugging electrical appliances.

Discussions based on everyday experiences and observations can help the children to understand these 'practices'. Demonstrations can also be useful even for those who have never seen an electrical appliance in use.

Demonstration

How should we use an electric iron?

Material required
electric iron

Ask the children to name the electrical appliances they have seen being used in households. Also ask them to recall some of the accidents associated with the handling of electrical equipment. Some may have a first-hand experience of being involved in such an accident. If students are not able to tell anything about such accidents, the teacher can read from some newspaper and tell the class about them.

After such a discussion, demonstrate how to plug in an electric iron, how to stand it, and how to store it. The children may be asked to describe situations which may be responsible for accidents connected with the use of electric iron.

A similar thing can be done with a table lamp.

Ask the children to collect news items from newspapers regarding accidents which have happened while handling electrical equipment, and to list the causes of the accidents.

For Better Understanding

It is very dangerous to use bare hands to pull a person who is receiving a shock from a live electric wire. The current should be switched off before touching the victim, or the person removing the victim should stand on a dry insulated surface such as dry wood. If this precaution is not taken, the rescuer may himself become a part of the electric circuit; he too may be injured or killed.

1(d). PRECAUTIONS SHOULD BE TAKEN WHILE PLAYING FIELD GAMES AND TAKING PART IN SPORTS

Play is an integral part of a child's life and also of the school curriculum. Children like to play many kinds of games which may or may not be safe—games such as kite flying and *gulli-danda*. Accidents may occur if the playground is not safe. For example, the surface may be rough, or there may be broken pieces of glass, fruit skins, or other rubbish on the ground. Sometimes the play equipment is defective. Another very important factor which causes accidents during play is that the rules of safety for the game or sport are not followed.

In the home, toys and other play articles should be stored in safe places and not left lying on the floor. This has sometimes resulted in broken arms or legs or other injuries. Schools provide opportunities for games and sports; these may very well be utilized as teaching-learning situations for teaching safe ways of playing games.

Discussion

What is the importance of rules for games?

The children take part in school games and sports. They can discuss the rules of the various games and can also frame their own rules to avoid accidents in the field. They should follow these rules while playing.

Help the children to form committees for framing safety rules for all the play activities organized in the school. These rules may *be circulated among the children or written in bold letters on a chart for future use.*

Take the children to the playground and demonstrate the safe use of play equipment, and other safety measures on the field. Ask the children to observe unsafe practices while other groups are playing and discuss the same in the class afterwards.

1(e). PRECAUTIONS WHILE SWIMMING

Though a majority of school children do not have facilities for swimming, there are still many places which induce children to swim. In villages, many children are found bathing in ponds, pools, rivers, canals, *nullahs*, etc. People living near the sea-shore, rivers, canals, lakes and other such places should realize that these present unsafe situations to individuals who do not know how to swim.

A person who does not know how to swim is more likely to drown if he enters into water of unknown depth. Small children should not try to swim where there is no adult who knows swimming and can take responsibility for their safety. Moreover, if they happen to see some one drowning they must shout immediately for help.

It is not safe to push other individuals who do not know how to swim into the water. Even if a good swimmer feels tired while swimming he should immediately come out of the water. It is not safe to go on swimming just to show off.

There is another aspect of safety in connection with water; it concerns the danger of infection. One should bathe or swim in clean and clear water. The water in a swimming pool or tank is not meant for drinking. It may be unsafe for drinking. Individuals using a pool of water for bathing or swimming should not make it dirty. If they have some infection or disease, they should not enter into the water. When using a swimming pool a bather should observe every rule and should also help others to observe them. An interesting discussion can help the children to learn about safety in water.

Discussion

How can we be safe while bathing?

Discuss the subject of safety rules while swimming or bathing. The students may be asked to frame rules to ensure safety while swimming. Challenge the students with questions such as 'Where is it safe to bathe?' 'How can a child learn to swim?' 'What should you do if another child gets into difficulties in the water?'

Show pictures of various dangerous situations to the class. Ask the students why such situations are dangerous.

1(f). PRECAUTIONS SHOULD BE TAKEN TO KEEP BROKEN GLASS, NAILS, SHARP INSTRUMENTS, AND POISON WHERE THEY CAN DO NO HARM

Carelessness is a major cause of many accidents and injuries. Children are apt to be careless unless they are taught to be careful. It is a common experience to see children breaking things made of glass or such other delicate material while handling them carelessly. They also get hurt while cleaning up the broken pieces. Sometimes, children may get hurt in an attempt to learn about the things around them. Sharp instruments, scissors, knives, blades, nails and other such things should not remain scattered on the floor after use, but should be stored in a safe place.

In class IV, a student needs to learn safety both for himself and also for those who are younger. Children should be careful when handling tools, either while learning how to use them or while repairing something. They should also be careful not to leave them scattered after use, lest others get hurt. Poisons are another source of many accidents. As a safety measure, they must be stored under lock and key. Other medicines should be kept at some other place. The containers for poisons should be labelled 'POISON' in large letters. Children should be taught all these safety measures so that they can practise them for their safety as well as for the safety of others. Such things can effectively be taught through activities such as these given below.

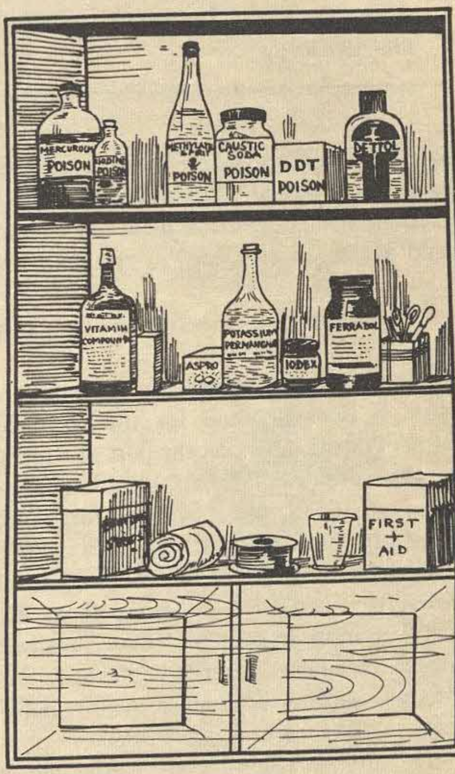

Fig. 11-1
Poisons should be clearly labelled and stored in a special place beyond the reach of children.

Discussion | **What are some common causes of cuts and poisoning?**

Engage the children in a discussion about their experience of accidents in their homes or in the school which result in wounds or poisoning. The causes of these can be discussed with the group. They may be divided into smaller groups to think about safety measures in relation to each of the causes. Help the children to prepare their own safety code. See Fig. 11-1 relating to the safe storing of medicines and poisons.

Help the children to act according to their self-made safety code in their classroom, around the school building, and in the playground.

Safety practices develop into an attitude after a long period and with continuous interaction with the environment. The teacher should act as an example for the students. Teaching can be very effective if teachers themselves practise what they teach to their students.

2. ELEMENTARY FIRST AID AND EMERGENCY MEASURES CAN REDUCE CASUALTIES

First aid is the first care given to an injured person. It does not call for the complete treatment of the injury on the part of the one who gives first aid. The important thing to keep in mind is the safety and comfort of the injured one until medical help is available. In case of minor injuries first aid may be all the help that is needed. In severe cases, first aid is even more important. There have been many cases when a person would have died if first aid had not been given in time before expert medical care was provided.

There are two kinds of critical emergencies in the whole field of first aid: (1) severe bleeding, and (2) stoppage of breathing. In other accidents there is some time available to call for help, or to think more about what should be done. But, in the case of severe bleeding and stoppage of breathing there is no time to lose or to run for help. Something must be done immediately for the injured, or he may die. This may happen anywhere, in any family, and at any time. It is for this reason that knowledge and training in first aid should be considered an essential for good citizenship.

First aid includes the skills of bandaging, carrying the injured from one place to other, and assisting the stricken person to breathe. In order to apply first aid effectively, one also needs to learn the elementary facts about how the human body works. A detailed account of what should be known is available in books written by specialists on this subject. The most easily available books on first aid are:

1. *Handbook of First Aid and Elements of Home Nursing and Hygiene*. (English). Col. M. Shankhla. Published by Central Health Education Bureau, Directorate General of Health Services, Kotla Road, New Delhi 1.
2. *First-Aid Book*. (English and Hindi). Published by St. John Ambulance, New Delhi.

2(a). BLEEDING MAKES A PERSON WEAKER

Children know that bleeding results in

loss of blood. They must have seen blood oozing out of a minor cut or flowing in spurts out of some major cuts or wounds. Blood is a life-giving fluid and thus bleeding makes a person weaker. Severe bleeding should be considered as a serious emergency. If some one is injured and there is severe bleeding, the first thing to be done is to stop the bleeding. It is difficult to give first-hand experience to children regarding this concept. However, verbal activities such as these given below can help them become more familiar with the idea.

Familiar Experiences

What happens to a person who has bled severely?

Explain and act out how a particular person who had received a severe cut and had bled profusely behaved and felt. Show a picture illustrating how a person feels and behaves after profuse bleeding. Ask the students to recall some such incidents and discuss them with other classmates.

Ask the children to play-act to illustrate the behaviour of a person who has bled a great deal.

2(b). BLEEDING CAN BE CHECKED BY SUITABLE METHODS

Bleeding is the result of wounds. Wounds are caused when the body tissues which keep the blood from flowing out of the blood vessels are cut. Wounds can be classified into three categories according to how severe they are: skin abrasions, small cuts, and large gashes. There are also three categories of bleeding: capillary bleeding, venous bleeding, and arterial bleeding.

Severe bleeding is one of the most serious situations for first aid. Often there is no time to find help. According to priority the objectives of first aid in case of bleeding should be: stop the bleeding, lessen the effect of shock, and check the entry of germs.

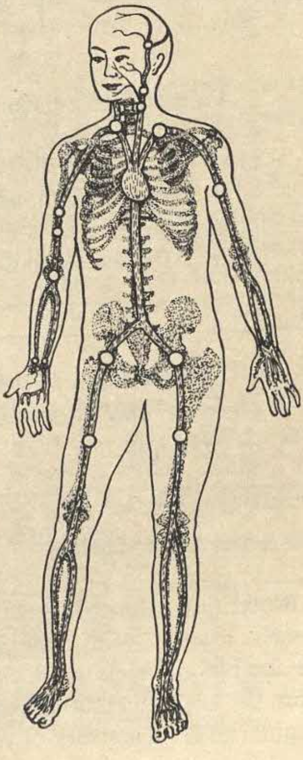

Fig. 11-2

Pressure applied to these points will greatly reduce the bleeding in a nearby wound.

Bleeding can be checked by firm pressure over the wound and tight application of a dressing. The easiest way to stop the flow of blood when no appliance is available is to plug it with the thumb or finger. The thumb should be clean so as to avoid infection. Thereafter, the thumb should be replaced with a suitable object like a pad of cloth held in place by a bandage. If bleeding continues the nearest *pressure point* above the wound should be pressed. A pressure point is a place where moderate pressure can stop blood flow. The major pressure points are shown in Fig. 11-2. Pressure should be released from time to time with a gap of 2-3 minutes to check whether the bleeding has stopped. In case this procedure does not work and the bleeding does not stop a *tourniquet* can be applied. A tourniquet is to be applied only if all the other methods fail to work. In case a tourniquet is used, pressure should be released from time to time to permit some blood to flow.

The children need to learn the *concept* of how to stop bleeding by giving first aid. They also need to learn the *skill* of giving first aid in case of bleeding. Practical activities such as are given here can be helpful for educators to provide appropriate learning experiences to children.

Demonstration

How should we give first aid in case of bleeding?

Materials required
handkerchief
bandages
cork pieces
stone pieces
wooden sticks

Ask a trained person to demonstrate what to do and how to do it, in case of bleeding. A child from the class can be used for the demonstration. It may be assumed that he is bleeding at some point. After the demonstration help the children to discuss the various possibilities and to repeat the operations so as to learn them by doing while the instructor observes, guides and corrects.

The students can be taken to some first aid post to help them to observe and learn about the process of giving first aid in case of bleeding.

For Better Understanding

Blood flows through three types of blood vessels: arteries, veins, and capillaries. Arteries are blood vessels which carry blood away from the heart to all other parts of the body. Capillaries are a network of very thin vessels. Arteries divide into finer and finer branches giving rise to this type of network. This makes it possible for the blood to reach all parts of the body. These capillaries combine and give rise to bigger blood vessels, the veins. The veins then carry the blood back to the heart.

The pressure of blood in the arteries and capillaries is greater than in the veins. This fact gives us a clue by which we can know whether the bleeding is due to an artery, vein or capillary cut. In case an artery has been cut, the blood flows out in large quantity and in spurts. If it is not stopped in time it may result in the death of the patient. Blood from a vein flows out steadily and with comparatively less force. When capillaries are involved in bleeding, either the blood oozes slowly all over the wound or it flows out steadily and not in spurts.

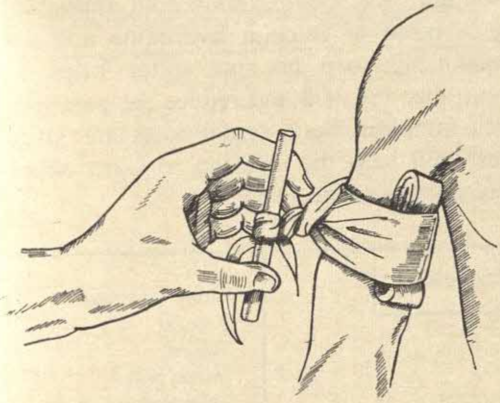

Fig. 11-3
A tourniquet can be made from a piece of cloth and stick; it is best applied at a pressure point.

A 'tourniquet' is an appliance which can be improvised with the help of any available stick, pencil, or similar object. It is generally used when it is difficult to stop the bleeding with the thumb for any length of time and also when greater pressure is needed. It is prepared by inserting the stick or a similar article into the knot of the piece of cloth tied near the wound as in Fig. 11-3. This stick is twisted to press firmly on the *pressure point*. In case of arterial bleeding, a tourniquet should be applied on the heart side of the wound. In case of venous bleeding the tourniquet is seldom needed.

2(c). A BLEEDING WOUND REQUIRES PROPER ANTISEPTIC DRESSING

Germs can enter through cuts and wounds. This is possible if the wound is left exposed to the atmosphere, or touched with dirty fingers, or bandaged with a piece of dirty cloth. Children should be taught about this and should know the following rules to avoid the danger of infection:

If the skin around a wound is dirty, it should be washed with soap and running water.

An antiseptic should be applied on the wound; then it should be covered with a sterile dressing.

The dressing should be light and tight, but large enough to cover the injured area completely. Another dressing should be applied over the original one if blood soaks through the dressing.

The children have learnt that there are germs which might be harmful to human beings. These germs cause various types of infections. Some activities which can draw the children into creative thinking on this topic are given below.

Discussion | **How can infection through wounds be prevented?**

Involve students in a discussion to list the possibilities of how infections can be carried into the blood stream through wounds. Also ask them to give one suggestion each on how to give first aid in case of bleeding and how to guard against the possibilities of infection.

Invite the children to interview some local doctors, compounders or nurses on this subject.

2(d). INSECT STINGS AND THEIR POISONS ARE USUALLY NEUTRALIZED BY AMMONIA OR LIME WATER

There are many types of insects whose stings cause severe pain or illness. The most common, which almost all children have seen, are bees and wasps. Some of the children will have received stings. Stings from bees, wasps, and scorpions are probably more common than other kinds of stings. These are very painful but do not usually threaten the life of a person.

The toxic secretion of insects is an acid which causes local inflammation and itching. The first aid should start with the removal of the sting if it is left in the skin. The application of an alkali such as baking soda (sodium bicarbonate), household ammonia, or a paste of calcium hydroxide and *sal ammoniac*, soap or lime water helps to neutralize the acid and reduce the pain and inflammation. Such activities as are given here will help the children to learn about neutralization effectively.

Demonstration

Alkalies neutralize acids

Materials required
vinegar
lemon
acetic acid
lime water
ammonia
blue litmus
glass jug
two glass tumblers

Take the bottle of vinegar or acetic acid. Tell the students that it is an acid and pour a few drops of acid into the water in the glass. Ask some of the students to taste it and report the taste to the class. Then add a few drops of blue litmus to this dilute solution of acid. It turns red. Help the children to smell the ammonia and tell them that ammonia and lime water are alkalies. Divide the dilute acid solution into two tumblers. Add ammonia drop by drop and go on stirring. Let the students observe the change in the colour of the solution. Stop when the colour disappears. Repeat the same process with lime water in the other tumbler. Tell the children that at this moment the alkali has neutralized the acid. Help them to taste the solution this time and see the difference. Add a few drops of ammonia and lime water to respective tumblers. The solution turns blue. Tell the children that it is alkaline now.

Investigation

How can we neutralize an acid and an alkali?

Materials required
- lemon juice or vinegar
- baking soda
- tumbler
- glass jar

Take dilute lemon juice in a glass tumbler and baking soda solution in another. Add the baking soda solution to the dilute lemon juice and watch the bubbles. When there is no bubble by adding more baking soda solution, the acid has been neutralized completely.

Ask the children to observe what the elders do in a family when someone is stung by an insect.

UNIT 11

SAFETY AND FIRST AID

CLASS V

Overview

In their previous classes the children were led to understand how some habits of safety are good for them and their community. Based on this understanding, they were helped to cultivate such habits. This was done for the children right from class I because it is always difficult to replace an old habit by a new one, no matter how good the latter may be.

Unit IV is very different from the other units in this syllabus. The concepts and understandings of this unit do not so much belong to the domain of knowledge as to those of attitudes and habits. Mere knowledge of safety rules will be of no use unless this knowledge is translated into attitudes and behaviour.

The subject-matter for class V, like that of class IV, has been treated in the typical style of the Teacher's Handbook—major concepts and sub-concepts. The first major concept deals with how safety habits are essential for the individual and the community. This very general idea is presented to the children through specific examples, e.g., a fire started by a careless throwing away of burning matches.

In addition, the idea has been emphasized that an individual's good is related to and is dependent upon the welfare of the entire community; for example, fires started by an individual's negligence may cause tremendous loss to the whole community.

Every precaution should be taken to prevent accidents. When accidents happen in spite of that care, one should know what to do to meet the emergency. Children should continue to learn these things and practise them whenever required. The second major concept discusses how learning and practising first aid can help children to develop into good citizens. Some first aid rules about burning and accidents involving fracture have been discussed in this major concept.

At all class levels, the materials involved in 'Safety and First Aid' are closely related to learnings in science and outside of science. Understanding the rules for safety involves some knowledge of force and motion, of the characteristics of heat, of the nature of electricity, and of the chemistry of burning. Teachers may wish to integrate teaching about 'Safety and First Aid' with certain other units which involve basic principles of science.

'Safety and First Aid' is also closely involved with social studies. This is particularly true in the cases of helping one another, community responsibility and agencies of law enforcement. Many teachers, therefore, like to integrate the material in this unit with their teaching of social studies.

In either of the above teaching plans, it is important that children understand the *logic* behind good behaviour patterns, that they *desire* to develop such patterns, and that they develop such behaviour as *habits*.

1. HABITS OF SAFETY ARE ESSENTIAL FOR THE INDIVIDUAL AND THE COMMUNITY

Children often fail to realize that they have been watched and protected all their lives by parents and other adults. Many times the little ones have been protected against danger by the adults, because they were too young to recognize an accident situation. However, it was not possible for adults to keep an eye on the children all the time. As a result, the children have had accidents and have learned some safety precautions through bitter experience. By now they are mature enough to recognize and even foresee the possibilities of dangerous situations and they can develop the concept that 'habits of safety are essential for the individual and the community.'

Accidents are responsible for a large number of deaths, and injuries which may be temporary or permanent. Most of these accidents can be prevented if the major causes for these are identified and steps taken to eliminate them. Accidents at home and in the community are usually caused by carelessness, hurry or disturbed emotions. Individuals and the community can be safeguarded against accidents and injuries if habits of safety are practised by individuals.

1(a). CARELESS THROWING AWAY OF BURNT MATCHES MAY START FIRES

Most fires are caused by carelessness. Sometimes just out of curiosity, little children attempt to light a match-stick. As a result, serious accidents often occur. Of course, this is not so much the fault of the child as that of the adults who did not keep the match-box out of his reach. Similarly, sources of fire such as an *angithi*, lanterns, or candles should all be kept out of the reach of the young ones.

The careless throwing away of burnt matches by adults is another cause of fire accidents. A safety habit can be developed in the children by letting them observe their elders following safety rules. In science classes, teachers have opportunities to educate children about safety with matches. In case matches are used to light a fire, they should be completely extinguished before being thrown away. A burnt matchstick should either be thrown into the fire itself or put into water after use. If it is thrown away carelessly, it is possible that some dry fuel or other inflammable materials may catch fire. Village children might have seen some situations when farm produce worth thousands of rupees has been reduced to ashes by such carelessness. To teach this subject, activities like these given below can be of great help.

Demonstration

Throwing of burnt matches may start a fire

Materials required
match box
spirit
kerosene
dry grass
paper

Invite the children to tell about the possible causes of the fire accidents they might have seen or heard about. Demonstrate how throwing away a burnt match-stick may result in a fire when there is some dry or inflammable material around. A burnt match-stick may be thrown over dried grass, pieces of paper, and spilled spirit or kerosene on the floor of the classroom. Again, the children can be drawn into a discussion as to what should be done to avoid such incidents.

Ask the children to list the fire accidents that have happened to them or in their neighbourhood or have been reported in newspapers and to write the possible cause for them together with the suggested safety measure that would have prevented these fires.

1(b). A FIRE MAY BE PUT OUT BY COOLING BELOW THE KINDLING TEMPERATURE, SHUTTING OUT THE AIR SUPPLY, OR REMOVING THE FUEL

Prevention is always better than cure. But, anyhow, if prevention fails or steps are not taken to prevent an incident, the last resort is the cure. If, in any case, a fire breaks out, the children should know how to extinguish it.

If it is available, water can be poured on many common fires. It helps to put out the fire by bringing the temperature of the burning fuel below the kindling point. However, water is not always so useful as many people think. It is quite impractical to use water on fires which involve petrol, or kerosene or any other oil. If a vessel containing such a liquid is burning, the water poured on it merely settles to the bottom since it is more dense than the burning liquid. Sometimes, the water poured on burning oils merely splashes them about and makes the fire even worse. Water on electrical fires can also be very dangerous, for, being a conductor of electricity, it sometimes causes short circuits and makes an electrical fire worse than before. Because of this, oil fires and electrical fires are usually handled with means other than water.

Investigation

How does cooling retard a blaze ?

Materials required
candle or spirit lamp
stiff paper
scissors

Cut a piece of stiff paper and fold it into a shallow tray as suggested in Fig. 11-4. Put some water in the tray. Now hold the tray directly over a small flame from a candle or spirit lamp. Observe the water carefully. Notice that although the water may be boiled, the paper tray does not catch fire! This is so because the water keeps the paper cool, and well below the kindling temperature for that material.

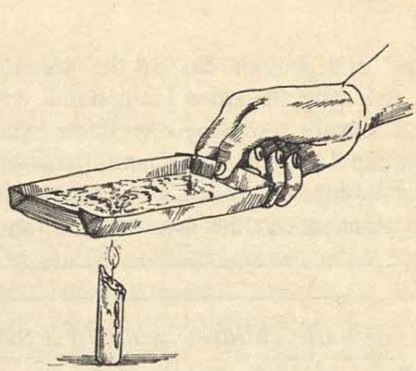

Fig. 11-4
The paper of the tray does not burn because water keeps it cool.

Another way of putting out a fire is to put sand or earth on it. Putting sand or earth on the fire cuts off the supply of air which provides the oxygen necessary for the fire to continue. In case a person's clothing catches fire, the air supply can be cut off by covering the person with a thick *durrie* or carpet.

Fires can also be controlled by removing the fuel. Fires in dry fields can sometimes be controlled by cutting down the dry plants in a row near the fire. In this way, the fuel is removed and the spread of the flames may be successfully checked. To teach the children about the procedures which help in extinguishing a fire such classroom activities as these can be of great help.

Investigation

How does shutting out the air supply help to extinguish fires?

Materials required
spirit lamp
match-box
glass tumbler
piece of paper
sand

Invite the children to watch the demonstration and note the reasons for the results. Light the spirit lamp and replace its cap over it. Remove the cap and ask the children to note what happened to the flame. Ignite the candle, place it on some uneven surface and cover it with the glass tumbler. It remains burning. When the same candle is kept on an even surface and the glass tumbler is placed over it, it is extinguished. See Fig. 11-5. Ask the children to discuss why it did not go out in the first

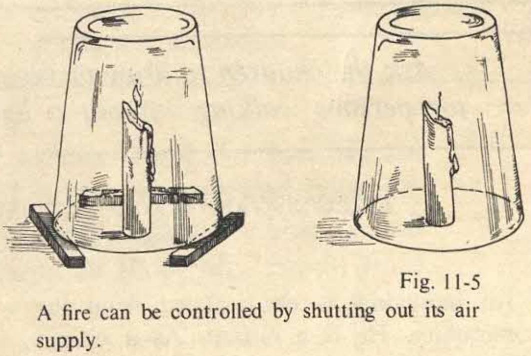

Fig. 11-5
A fire can be controlled by shutting out its air supply.

case and why it did in the second.

Ask why the spirit lamp flame was put out by covering the flame with the cap ? If the children cannot answer, ask additional questions to lead them to think about the fact that air must be available to keep the flame burning. Demonstrate by setting the piece of paper on fire and extinguishing the fire by covering it with sand. Ask why covering the fire with sand helps to extinguish the blaze.

Ask the children what first aid measures they adopt when someone's clothes catch fire.

1(c). WHEN WALKING IN THE DARK, USE A LIGHT TO AVOID SNAKES

It is dangerous to walk in the dark. The visibility at night, particularly during the rainy season, is poor. It is difficult to see any ditches, stones, bushes, etc., while walking in the darkness. There may also be slippery ground where one can slip and get hurt if he walks carelessly. There may be insects or animals such as snakes, scorpions and jackals, specially during the rainy season. It is always a safe practice to carry a torch or lantern when walking at night. Wearing white clothing while walking at night is also a safe practice. This helps others to locate you and avoid a collision. Classroom activities for a better understanding of this topic may be performed as suggested below.

Familiar Experience

What are some hazards responsible for accidents at night?

Invite the children to recall the accidents that they, their friends or other people had during the nights of the last rainy season. List them on the blackboard while they tell about them. Ask the children to suggest safety measures that would have prevented these accidents.

Ask the children to draw pictures of possible accident situations for persons walking without a light at night.

2. LEARNING AND PRACTISING WHAT TO DO IN EMERGENCY SITUATIONS IS ESSENTIAL TO GOOD CITIZENSHIP

An individual is not isolated from the community. He is a citizen. As a citizen it is essential for everybody to know the skills of first aid in case of emergencies.

In this way immediate help can be given to the injured; this may even save his life. The services of a doctor are not always available at the time of the accident and the patient may have to wait for several hours until medical aid is received. In the meantime if even first aid is not given to the patient, his injuries may prove fatal. Whatever one knows to meet the emergency, must be done. What has happened to someone else this time may some day happen to oneself. Therefore, as a good citizen, everybody should learn the skills of providing first aid and should continue to learn what to do in specific emergency situations.

In every field improved methods are being discovered continuously. For example, mouth-to-mouth breathing was not widely used until recently as a device for artificial respiration. Yet, it now proves especially useful with babies and small children. Hence, learning should never stop at any point; it is a life-long process.

2(a). BURNS REQUIRE PROTECTION FROM AIR AND GERMS

All children experience minor or major burns at one time or the other. Matches, hot stoves, open flames, hot utensils, boiling water or fat are the common causes of burns. The children should know what to do in these situations and how to do it. They should know that the blisters of a burn are not to be broken. The burn should immediately be covered with a sterile dressing if available; otherwise, a clean cloth can be used to prevent infection. The dressing can be of a closely woven gauze or a soft material which can be used next to the skin. Care should be taken to ensure that the dressing covers the entire burnt area. In no case should absorbent cotton be used as it will stick to the burn and will be difficult to remove. There are cases where the application of grease also helps. How to apply the dressing in case of a burn can best be taught by a demonstration by the trained instructor.

Demonstration **How should we apply dressings for burns ?**

Materials required
closely woven sterile gauze dressing
clean soft cloth

Invite the children to observe how the dressing is done in case of a burn by a person trained in first aid. The demonstrator may pick any child from the class and demonstrate the dressing of various parts of the body in case of a burn. After each demonstration, the students can practise the same procedure on one another while the teacher guides and supervises.

Assign for reading the related portion from the book Hand Book of First Aid and Elements of Home Nursing and Hygiene, *published by CHEB, D.G.H.S., New Delhi.* When the Unexpected Happens (*English*) *and* Durghatanaon se Bachiyay (*Hindi*) *from the same source are also useful.*

Ask the students to keep a record of accidents in their locality and school and to find out how many out of them are cases of burns.

2(b). A PERSON WHO IS BADLY BURNT REQUIRES PLENTY OF LIQUIDS TO DRINK

Burns can be classified into three categories or degrees. In the first degree burns there are no blisters but the skin is reddened, swollen and painful. Only the upper layer of the skin is involved. In the second degree burns blisters occur. Though the tissue destroyed in such burns heals, there may be some scarring left. Thus only the top layers of the skin are destroyed in this case. A third degree burn destroyes the skin and some underlying tissues as well. The surrounding surface may appear charred. This type of burn is slow to heal. It is in case of third degree burns that much body fluid is lost through the skin and the patient may develop a severe state of shock. To compensate for the loss of body fluid, plenty of liquids in any form should be given to the patient to drink. This is the first thing to be done in case of severe burns. Here is an activity which may be undertaken in the classroom to enable the children to comprehend the idea of fluid intake in case of burns.

Familiar Experiences and Discussion

Why is plenty of water needed in case of severe burns?

Invite the children to tell the ways in which their body loses water and how that loss is recovered. Ask them to tell in what form water remains inside the body. Let them recall what happens when the skin is cut and also when there is a burn. In case of severe burns what will happen to the water reserve of the body ? What should be done to replace it when there is a loss of body water ?

These questions will help children to assimilate the fact that in case of severe burns the patient should be given plenty of water to drink.

2(c). A FRACTURED BONE SHOULD NOT BE MOVED WITHOUT PROPER SUPPORT

Fractures can occur anywhere: at home, on the road, and in the school. While playing, a child may collide with the classroom furniture, or may fall on the playground or on the stairs. These and many other situations present the danger of bone fracture. The indications which suggest a fracture to one who gives first aid are:

A fractured bone is a painful injury. A person with a fracture cannot normally move the injured part.

The site of the break swells rapidly and is very painful to touch.

The fractured bone needs great care and proper support to prevent further injury. As far as possible, the injured person should not be moved from the site of the accident. First aid should be given on the spot, as moving the patient may cause further complications. Also, while moving, the sharp and pointed edges of broken bones may injure some major blood vessel.

The broken part of the body should, as far as possible, not be moved. But if it is absolutely essential to remove the patient from the place of the accident, tie a splint securely above and below the fracture as suggested in Fig. 11-6. The patient should then be moved very slowly and carefully from the position in which he was found. If splints are not available on the spot a rolled magazine or a folded newspaper or a piece of cardboard may be used. In case the broken bone protrudes through the skin a clean dressing can be wrapped round it before splinting. In addition to splints, a sling is often needed to support a fracture. The sling may support a broken leg while the victim is being carried in a stretcher.

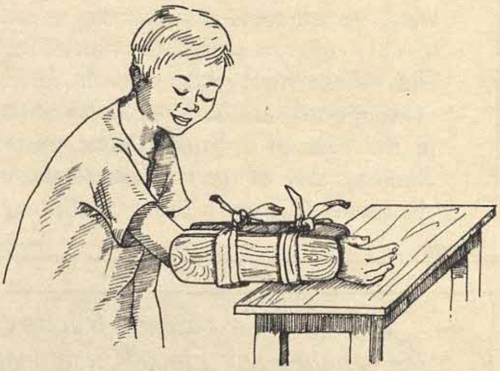

Fig. 11-6
The splints can keep the fractured bone from moving. The broken arm will also be supported in a sling.

Often a sling is used to support a broken arm for as long as it requires to heal. Some activities which can be used to educate the children regarding the care of fractures are suggested here.

Investigation

Why is some support necessary in treating a bone fracture?

Materials required
straight dry stick
small flat boards
cardboard or newspapers
string

Prepare a model of bone fracture by breaking a straight, dry stick. Make the break over a sharp corner so that the ends of the break are somewhat regular, as suggested in Fig. 11-7.

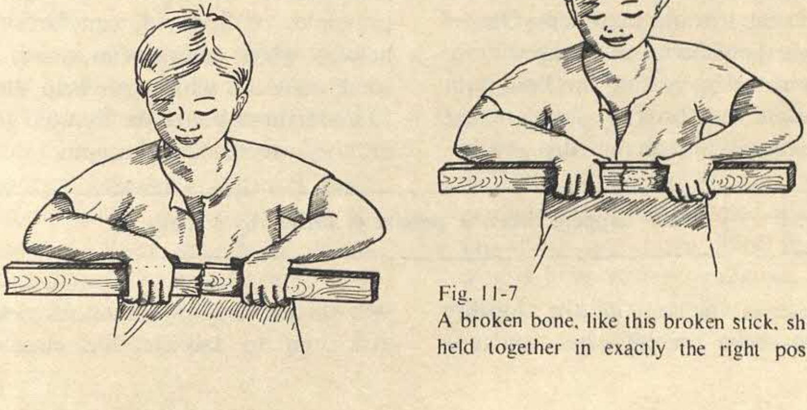

Fig. 11-7
A broken bone, like this broken stick, should be held together in exactly the right position.

Help the students observe that there is only one position in which the ends of the stick really fit each other, as suggested in the sketch. So it is in the case of a broken bone. Now challenge one of the students to move the model fracture without its slipping or bending in any way. Put a splint in place, using boards or cardboard or newspaper. Help the students to realize that this kind of support keeps the model fracture from slipping or twisting or bending while it is being moved.

If there is a case of fracture in the school or outside nearby, the teacher can himself demonstrate and educate the children by actually giving first aid to the injured.

2(d). SNAKE BITES SOMETIMES REQUIRE IMMEDIATE FIRST AID

The students have learned in class IV about one of the most serious kinds of emergency that he who gives first aid may encounter. This is the case of severe bleeding when there is no time to waste. There is another such serious situation which many children see or hear about in the villages and in the fields. This is the case of snake bite. Sometimes this kind of accident requires attention without delay.

If there is any chance that the snake which bites a person is poisonous, certain steps must be taken at once. The venom from a snake affects the victim by circulating through the blood stream. Accordingly, there are two phases to the first aid treatment. One of these is to get the venom out of the wound. Often this is done by cutting the flesh with a knife or even with broken glass, so that profuse bleeding can occur; this washes much of the venom out of the wound. The other step is to keep the victim as quiet as possible. If this is done, his blood circulation remains somewhat normal, and the poison does not circulate so quickly through the body. This means that the victim should not run, or even walk, home. If possible, he should be carried to a place where he can be comfortable and where he can get medical assistance.

Serious situations are often difficult for class V students to handle properly. Sometimes, however, it becomes necessary for them to take such action, or to know why such action must be taken, perhaps on themselves. Experience has shown that primary school children, if they do know the principles of first aid, can be surprisingly helpful when emergencies arise. Here are some activities which can help the students to understand better the first aid procedures in the event of poisonous snake bites.

Interview

What happens when a person is bitten by a snake?

Locate a person in the locality who has been present when someone was bitten by a poisonous snake. Ask him to talk to the class and describe what happened. If he was the victim, he can describe vividly how he felt. What were the first aid measures that were taken? How effective were these measures? How could the treatment have been improved?

Determine which are the poisonous snakes in the vicinity. Help the students to learn their names and to identify them in the field. Impress on the students that a bite from a non-poisonous snake is no worse than a minor scratch.

Although any accident can be serious, most first aid situations are not matters of life and death. There are, however, a few, where prompt and effective action must be taken if a life is to be saved. In class IV the students have learned how to handle one of these—severe bleeding. The case of poisonous snake bites has been discussed above. Another life-and-death situation is that where a person has stopped breathing, as in case of electric shock, or drowning or other form of suffocation.

It is a good thing, of course, if a capable adult is around when such emergency situations occur. However, such is not always the case. There have been instances where primary school children have saved the lives of adults because they knew the principle of handling a situation where breathing has stopped. The principle and the practice of mouth-to-mouth breathing are not difficult to understand. They can be taught to class V students.

Human beings, like other living things, continuously need oxygen to be alive. This oxygen they breathe in as a part of the air during the process of respiration. In any case of stopped breathing artificial respiration is immediately needed to save the life of the victim. A trained person should instantly start giving artificial respiration to the patient while arrangements are being made to secure medical care.

The main principle behind any procedure of giving artificial respiration is that 'The passage from the mouth to the lungs is to be kept open and alternate expansion and contraction of the lungs is to be provided'.

The mouth-to-mouth method is superior to other methods especially in the case of babies and young children. Moreover, this method can be continued for an hour or even more without fatigue. Even children can save the lives of adults by using this method if they are properly trained. The various steps which should be taken by a first aider while giving mouth-to-mouth respiration are given below in sequence. See also Fig. 11-8 a-c.

Place the patient on his back and turn his head to one side. Wipe out his mouth with the fingers or with a piece of cloth to clear anything obstructing the air passage to the lungs.

Tilt the head of the patient slightly back so that the chin is pointing upward. Hold the lower jaw with both the hands to lift it from beneath and behind so that, it juts out, to avoid the possibility of obstruction of the air passage by the victim's tongue. Hold the jaw in this position with the left hand and insert the thumb of the same hand between the teeth of the patient, pressing against the tongue; with the right hand pinch the victim's nostrils shut, place your mouth

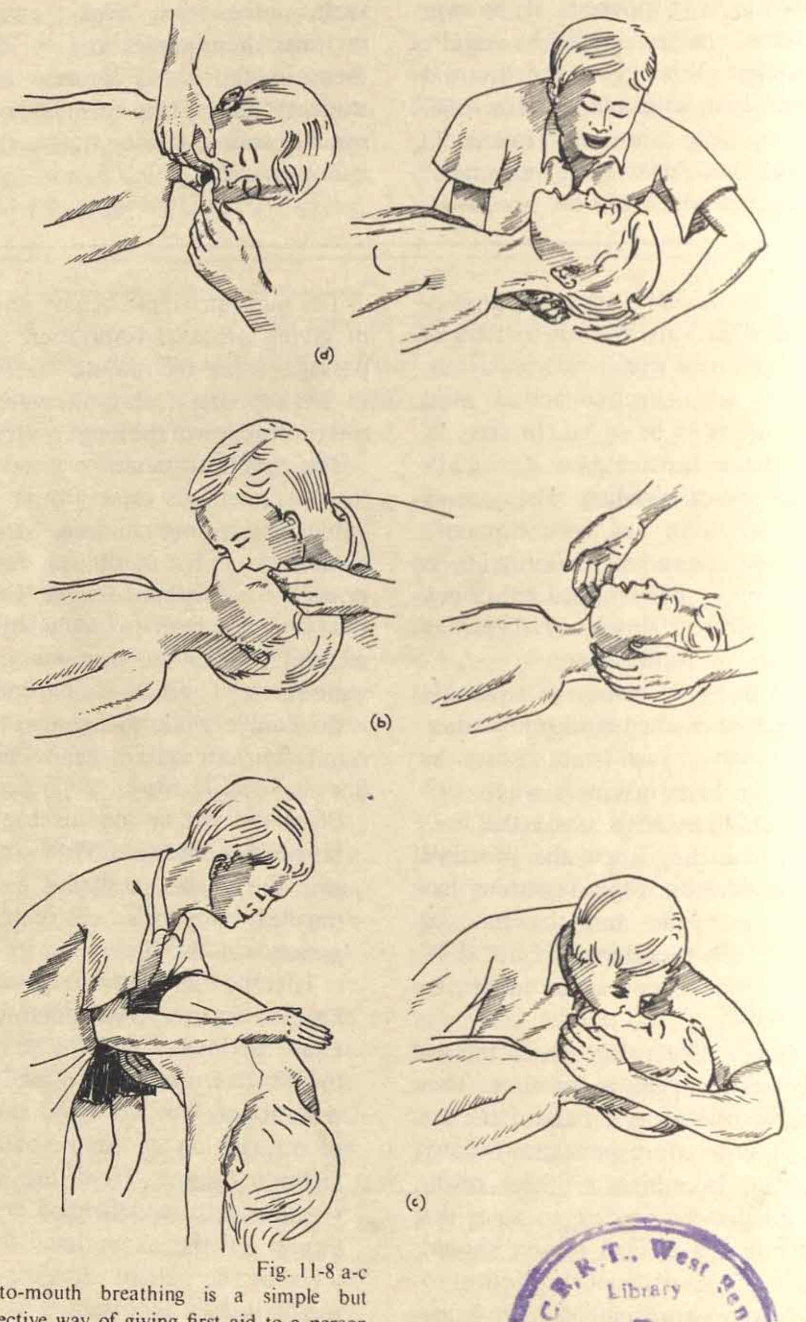

Fig. 11-8 a-c
Mouth-to-mouth breathing is a simple but very effective way of giving first aid to a person whose breathing has stopped.

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wide open over the mouth of the victim, and blow into his mouth forcefully.

In case of babies and small children the mouth should be placed over the child's mouth and nose, making a relatively leak-proof seal. Breathe into the child, using shallow puffs of air appropriate to the size of the victim.

Remove your mouth, and take another breath; listen for the rush of exhaled air which means the victim is responding to the treatment.

Repeat the action of blowing about 12 times a minute in the case of adults and 20 times a minute in the case of small children.

Now and then sweep the fingers through the patient's mouth to remove any foreign body. If vomiting occurs, turn the patient on his side immediately and wipe out his mouth.

Continue until the patient is breathing regularly. Keep the patient warm.

Activities such as these given below can be utilized for this purpose.

Discussion

How is mouth-to-mouth respiration given?

Draw illustrations depicting various steps in the process of giving mouth-to-mouth respiration, without captions, on the blackboard. Ask the children to list the various steps of the process shown through the pictures.

Ask the students to describe situations in which mouth-to-mouth breathing might be needed.

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